FEBRUARY, 1929

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
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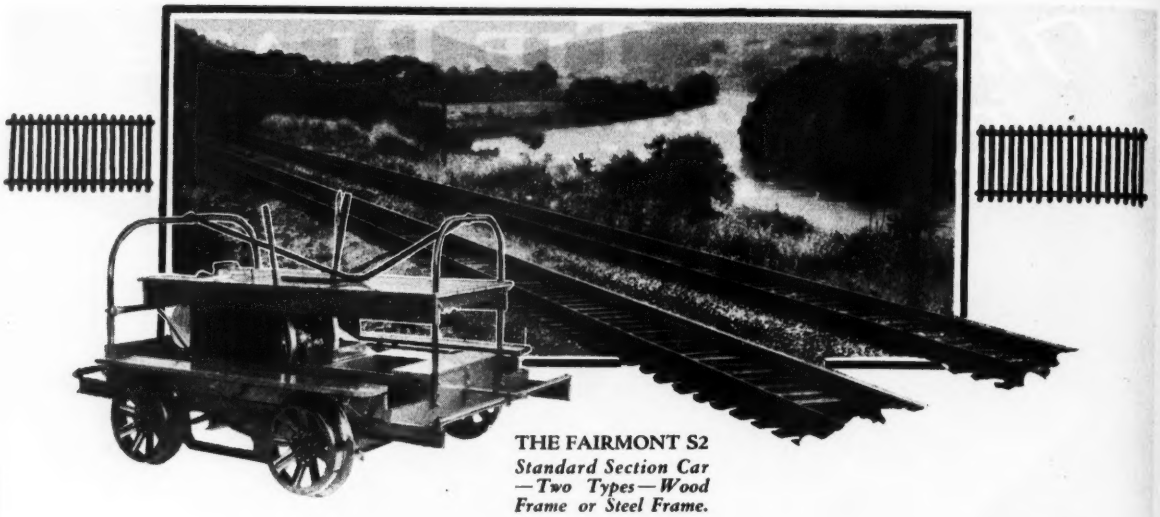

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Standard Section Car —Two Types—Wood Frame or Steel Frame.

today's higher Quality and Fairmont

The builders of Fairmont and Mudge Railway Motor Cars are not satisfied with meeting present-day needs in motor-car-service—their *ideal* demands planning ahead for the needs of far-off days to come. As the forward vision of railway engineers is constantly achieving betterments in railroad service, so Fairmont devotes its utmost engineering skill, facilities and long experience to the development of motor cars which shall keep step with those improvements.

Over half of all the motor cars in use are Fairmont Products—a tribute to Fairmont efficiency and quality.

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FROM 15 to 75c per cubic yard has been considered a fair price for building out shoulders on the Union Pacific until a Northwest dragline working from the ditch tackled the job near Frankfort, Kansas, and built out shoulder along 1350 feet of track per day.

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CRANES · SHOVELS **CONVERTIBLE** *and* DRAGLINES

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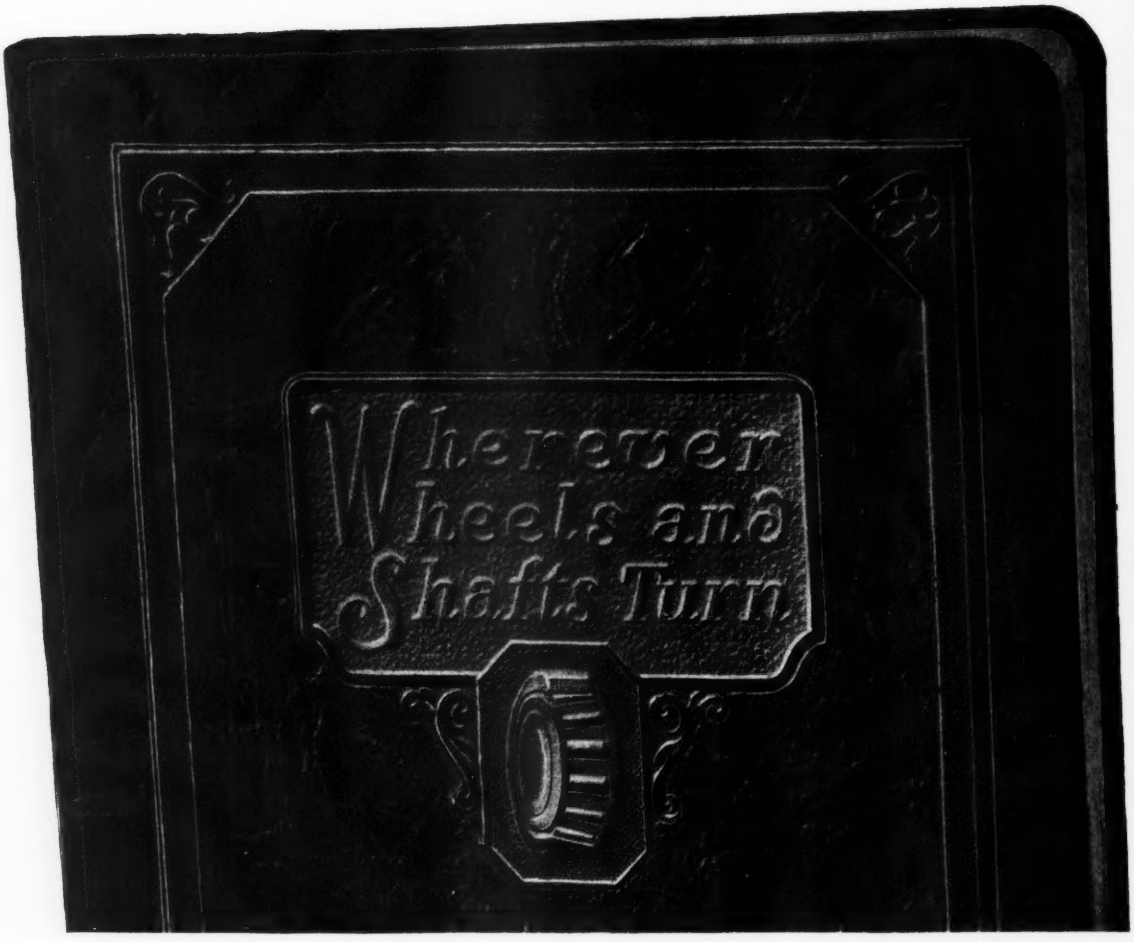

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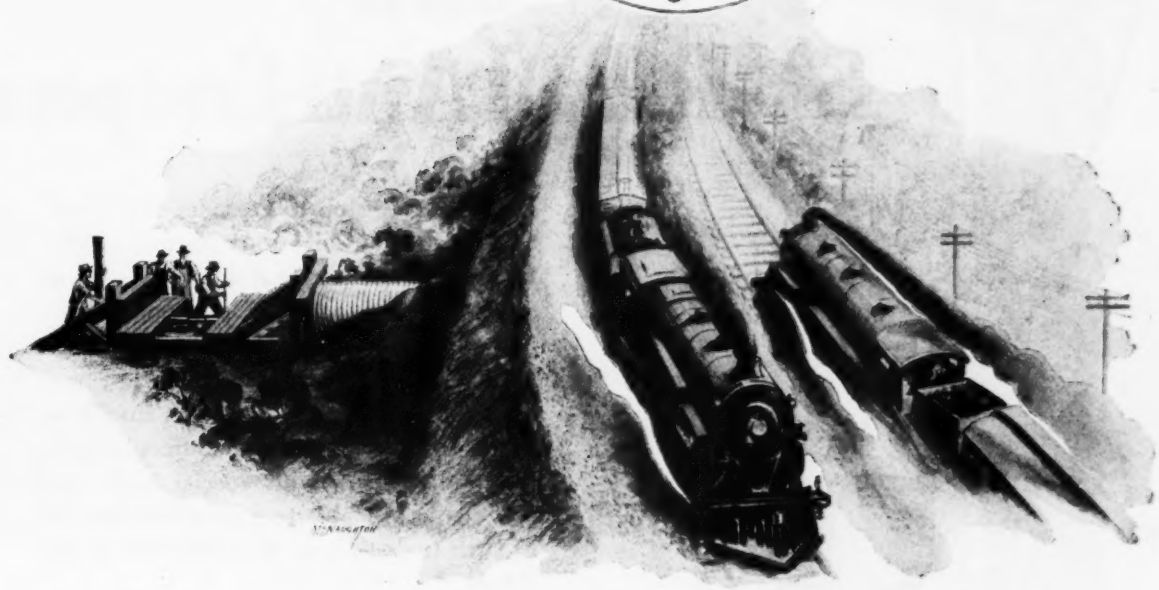
The new 150 page Timken Book shows how universal Timken Bearings have become in every kind of equipment—how they have revolutionized operating and maintenance costs wherever wheels and shafts turn throughout all Industry—how they can do the same in all of the equipment used in your plant.

It is of ***double*** value to you because it contains so much technical information on bearing mountings and installations. It deserves a permanent place in your library. A copy? For the asking!

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Not a minute's delay of a single train



When this culvert went in place—

"IT was an unusual thing to us—a culvert put in place without issuing a single 'slow order.'

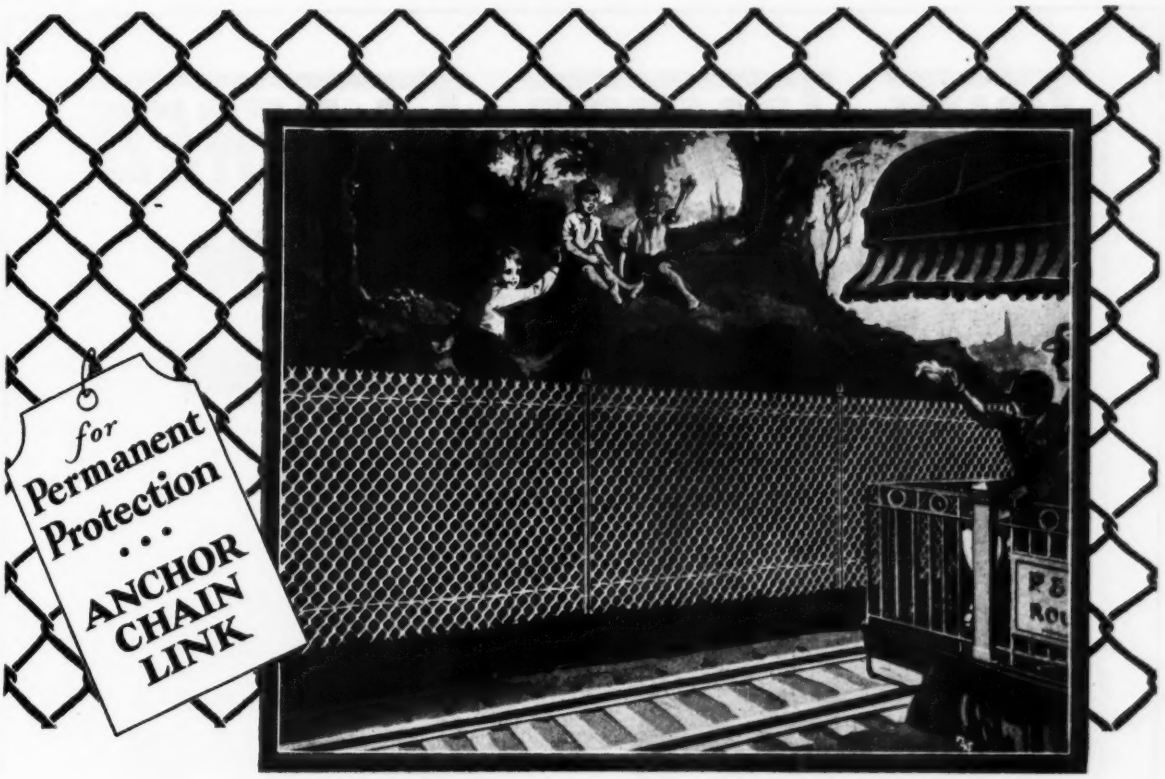
"What is more, the installation was made at a substantial saving. The final report shows an actual cost of only 40 per cent of the original estimate for a trench job. Another thing, the roadbed being undisturbed, there can be no subsequent settlement to increase the maintenance cost.

"But most important, of course, was the perfect operating condition of the track during the job. Not a minute was lost by a single train!

"Any engineer or official interested in maintaining schedules, should get complete information on the Armco jacking method of placing pipe under existing track."

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

ARMCO CULVERTS



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specify Anchor Chain Link Fence

INSPECT an Anchor Chain Link Fence after it has served for a score of years. You will find it strong, firm and perfectly aligned—ready for many more years of protective duty.

Durability is built into Anchor Chain Link Fences. The fabric is made of rust-resisting copper-bearing steel wire, heavily coated with zinc, *after* weaving. Construction of this kind insures permanency — low cost-per-year service.

Drive-Anchors, U-bar line posts of high carbon steel, and other exclusive Anchor features provide exceptional endurance in posts, gates and anchorage. At every point an Anchor Chain Link Fence is built to withstand severe service.

Anchor Offices in 75 principal cities from coast to coast are ready to give you the facts about the economy of Anchor Chain Link Fences. Get in touch with the nearest office, now.

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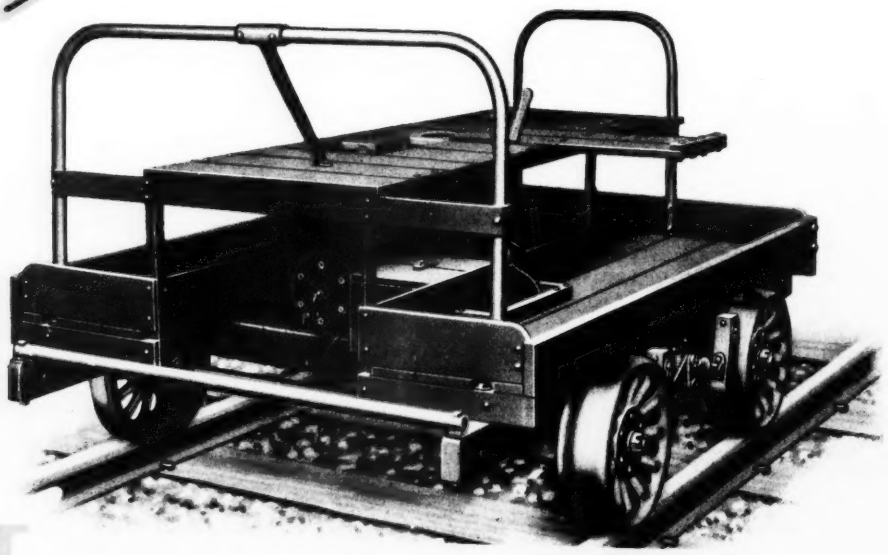
ANCHOR Fences

MADE BY THE MAKERS OF AMERICA'S FIRST CHAIN LINK FENCE

"Sheffield"



Look them over!

Look over the motor cars at the show. But go behind the price tags—look at the way the cars are *built.*

Fairbanks-Morse can build cheaper cars than their Sheffield line—but Fairbanks-Morse cannot build as good a car as "Sheffield" for less than Sheffield prices. The Sheffield policy aims at low *over-all* cost of the car—not the price for which it sells.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; electric motors; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

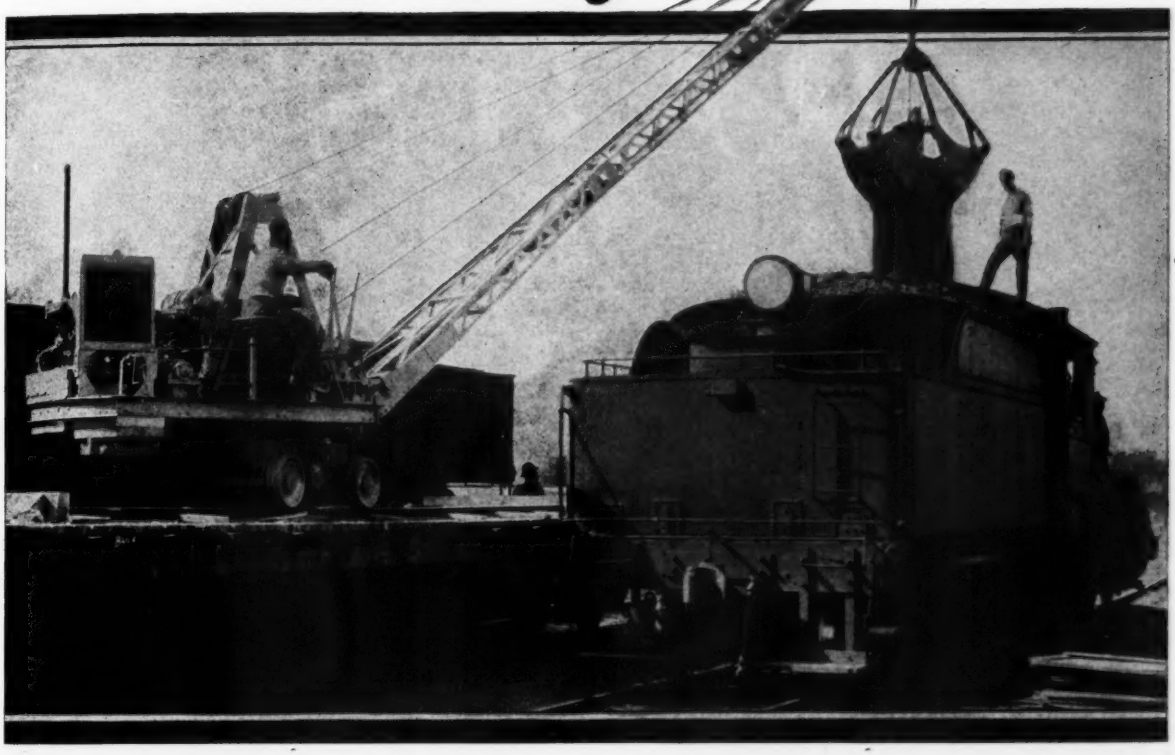
FAIRBANKS-MORSE

TIMKEN BEARING EQUIPPED

MOTOR CARS

RA 21.49

Every day it pays its way—



LOW original cost, easy and economical operation, one-man control and speedy action throughout make the Buckeye Utility Crane highly profitable for a wide diversity of construction and maintenance tasks.

Its flexibility adapts it equally well to a great variety of operating duties. When not in use for laying track, grading or other construction or maintenance work, it can be employed advantageously for transferring coal from cars to locomotive tenders or storage piles, loading cinders from ash pits into cars for removal, unloading engine sand, handling miscellaneous materials, etc.

Flanged wheel mounting enables it to operate directly from the track, traveling from one location to another under its own power. The same mounting permits efficient operation from rails laid on flat cars. Alligator (crawler) traction fits it for other service independent of track.

Quantity production of one standardized model makes possible the remarkably low price of $4800 for this rugged little Buckeye, f.o.b. factory, including steel cab and flanged wheels.

Every day it pays its way—because of its ability to handle profitably some job or other at any time.

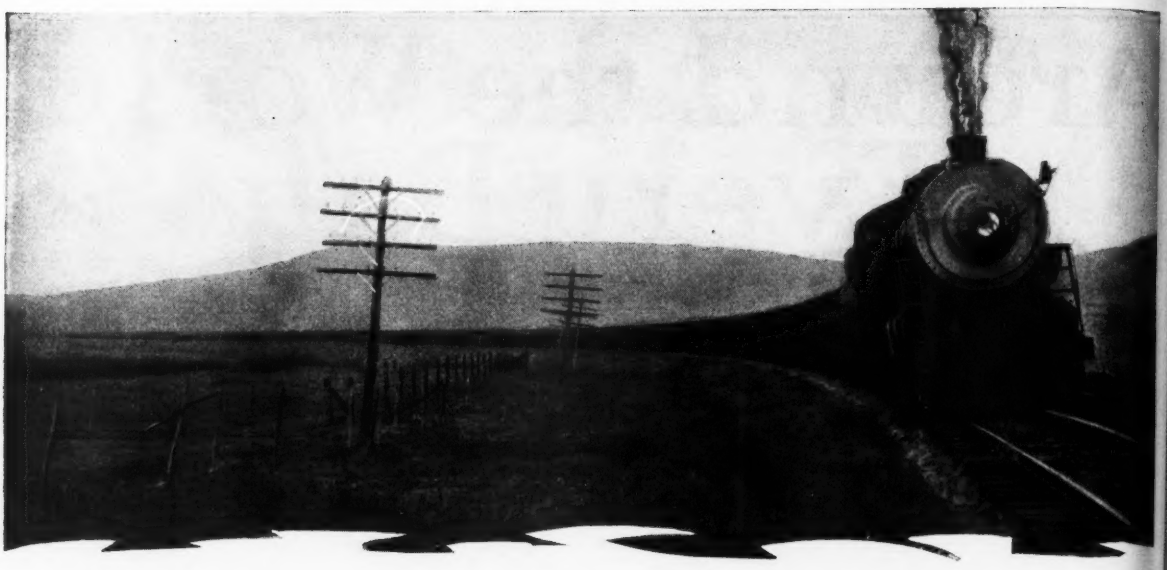
The complete construction and performance details in our Crane Bulletin will interest you. Ask for your copy.

THE BUCKEYE TRACTION DITCHER COMPANY, Findlay, Ohio

There's a Buckeye Sales and Service Office near You

for over thirty years

Buckeye



CURVES LIKE THIS NEED MEXICAN GRAPHITE CURVE GREASE

THE train shown above consists of 100 loaded cars and it is at points like these that emphasize the need for Mexican Graphite Curve Grease for protection to wheels and rails alike.

Statistics show that the cost in turning locomotive tires and the loss in car wheel and rail wear is enormous to American railroads. It means time out of service of both cars and locomotives, besides the cost in labor of making repairs and renewals. Mexican Graphite Curve Grease on curved track forms a bulwark of protection against wear of wheel flanges, prolongs the life of rails and saves the frequent expense of locomotive and car wheel repairs.

Why not give Mexican Graphite Curve Grease a trial on one of your curves. You will find it saves as it serves.

Winter Curves

NEED the protection that Mexican Graphite Curve Grease affords by its ability to adhere to the rail despite rain, snow and adverse weather conditions. It is ideally suited for use in automatic rail lubrication and carries a long distance beyond them.

Prepare now for Winter—send for a trial application

The United States Graphite Co.
Saginaw, Michigan
Philadelphia New York Chicago
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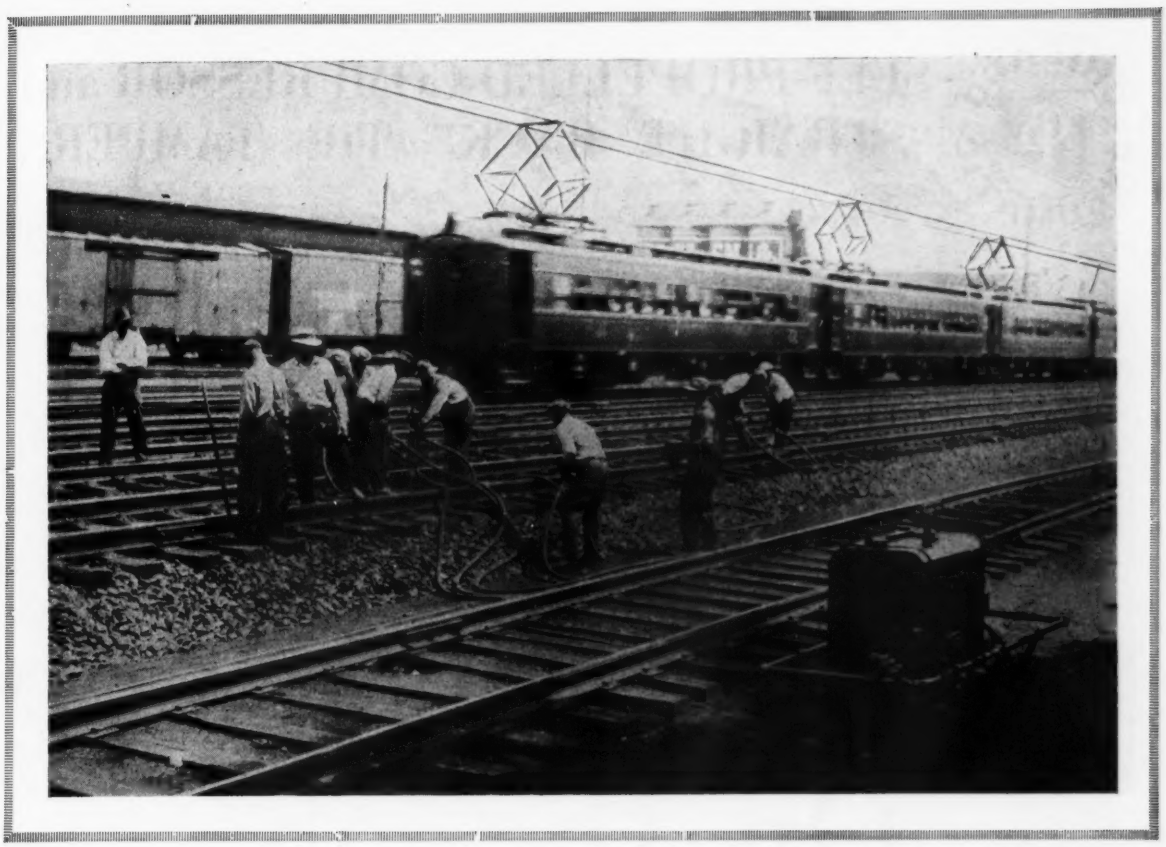
Mexican Graphite Curve Grease USG
SAVES RAILS ~ REDUCES FLANGE WEAR



SYNTRON Tamping Outfits Cut Costs

THE Syntron tie tamping outfit is entirely different from any other. It works differently—it is more flexible—it is easier to handle and it does a better job of tamping.

The Syntron Power Plant is light—portable and easily handled. The entire unit is only 20 inches wide. It can be set anywhere and requires no special cribbing. Easy to move, can be lifted by four or five men, rolled along the rail on dolly wheels, and set in position very quickly.

The Tampers are comparatively light—strike 1500 powerful blows a minute, packing a firmer and smoother roadbed. There is no strain on the operator, as he merely guides the tamping bar into position. Tampers have only one moving part, the piston, which cannot be stalled.

Four men equipped with Syntron Tampers can do the work of sixteen men with tamping picks or bars. A Syntron tamped track will stand up twice as long as a hand-tamped track.

New Catalog—Shows the Syntron Track Maintenance Tools

Tampers	Rail Drill
Spike Driver	Rail Saw
Nut Tighteners	Arc Welders
Power Plants	Power Cars

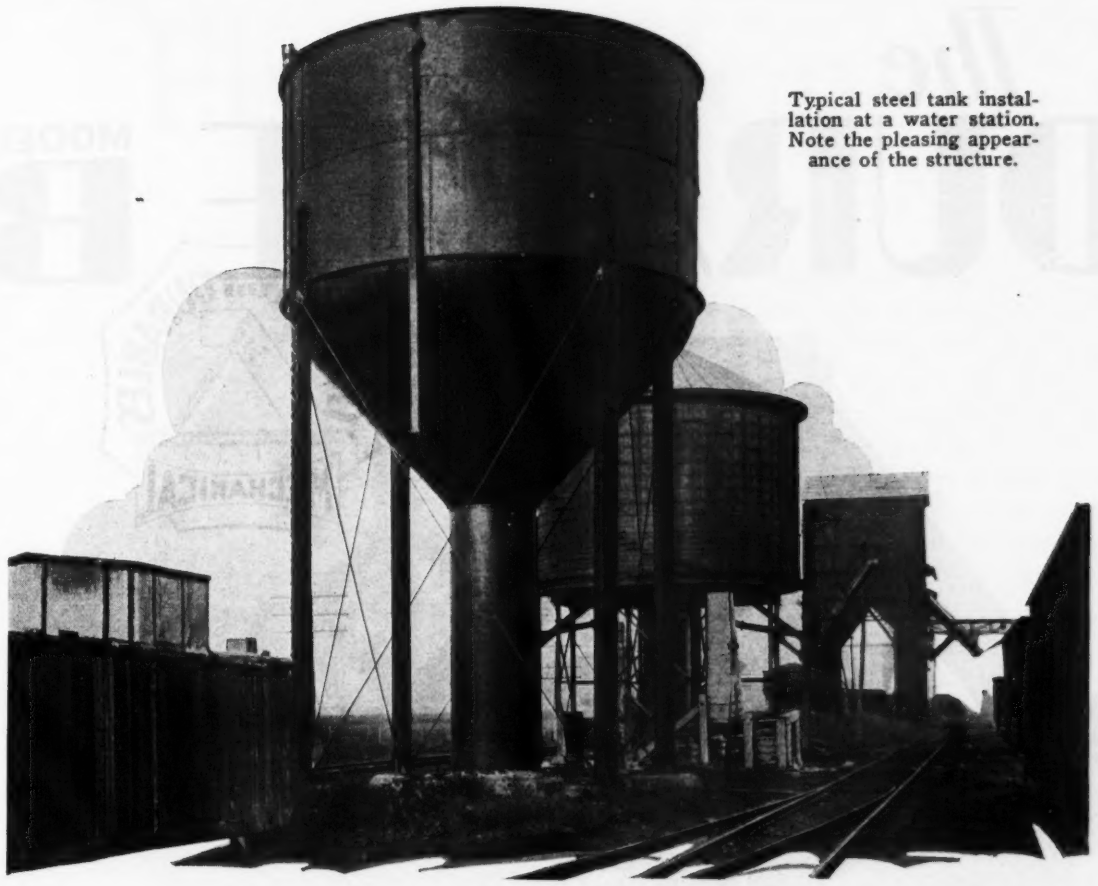
Track Grinders
and other electric tools

Send for this catalog—now!

SYNTRON COMPANY
400 Lexington Ave. Pittsburgh, Pa.

SYNTRON *Electric* TIE·TAMPERS

POWER UNITS AND TRACK MAINTENANCE EQUIPMENT



Typical steel tank installation at a water station. Note the pleasing appearance of the structure.

Use Elevated STEEL Tanks When Enlarging Water Stations

Elevated steel tanks are available in the large sizes necessary to take care of increased water demands. Their use is in line with the lengthening of distance between water stations and present day large tender capacities.

The installation of well-proportioned, long-lived steel tanks is also in line with present day operating economy as practiced by railroads.

The only maintenance required to keep them in good condition is a coat of paint every few years. Seldom is it necessary to make extensive repairs or replace parts of the structure.

Ask our nearest office for a copy of the booklet entitled Meeting Railroad Requirements with Horton Steel Tanks. It gives detailed information about the conical-bottom and ellipsoidal-bottom types.

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Chicago.....2452 Old Colony Bldg.
New York..3156 Hudson Term. Bldg.
Cleveland.....2202 Union Trust Bldg.
Dallas.....3309 Magnolia Bldg.
Detroit.....1519 Lafayette Bldg.
Philadelphia.....1609 Jefferson Bldg.
Atlanta.....1036 Healey Bldg.
San Francisco.....1007 Rialto Bldg.

B-59

HORTON TANKS

One tiny vulnerable spot — Death found it!

THETIS, goddess mother of mortal Achilles, Hellenic hero of Trojan war, plunged him into the River Styx to make his body invulnerable. But she held him by one heel, which the waters did not cover with their protective charm. Before the bloody walls of besieged Troy, Achilles wrought havoc and destruction among the Trojans, himself escaping wounds, defying harm. And then, as he stood in the temple of Apollo, negotiating with Priam for the hand of his daughter, Polyxena, the poisoned arrow of treacherous Paris found his vulnerable heel, dealing death. The magic of the Styx was good protection as far as it went. But its application had lacked thoroughness.

It is fact, not legend, that destructive termites (white ants), woodpeckers, decay-producing fungi or marine borers are swift to find the vulnerable spots in partially, improperly or under-treated transmission poles, cross ties, bridge timbers or piling. Spotty or uneven penetration of the preservative does not afford complete protection. And treated wood is no safer than its least protected spot.

Thoroughness distinctively characterizes Prettyman timber preservation. The most complete and modern pressure treating plant in the industry, coupled with finished engineering skill and care, assure deep and uniform penetration full length to the heartwood with creosote oil conforming to standard A. R. E. A. specifications. It completely encases the heartwood in highly toxic sheathing, thick as the sapwood itself. It leaves no vulnerable spots. Yet, Prettyman Preserved Forest Products cost no more. Write for prices.

No vulnerable spots here!

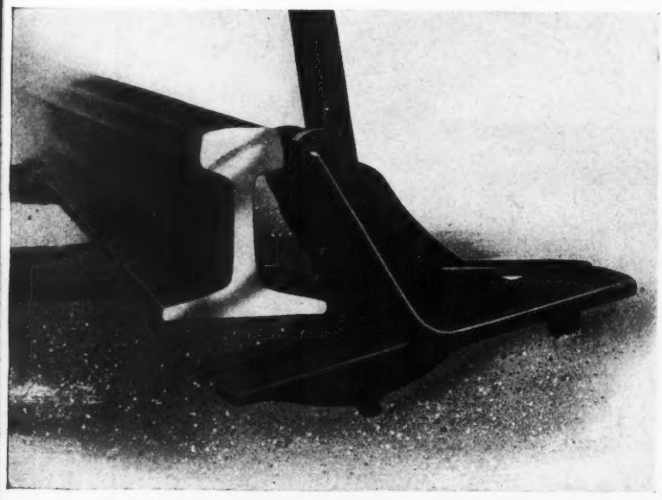
Note thorough penetration of creosote oil

PRETTYMAN PRESERVED FOREST PRODUCTS P29

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

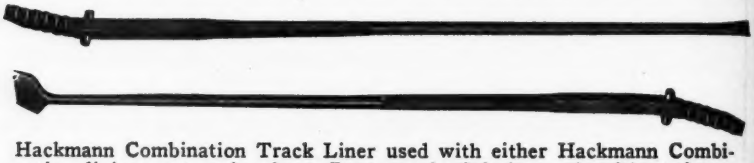
Hackmann Combination Track Liner

Consisting of a Base and a Bar. You Can Have Your Choice of Either a Lining or Tamping Bar



Proper position for setting Hackmann Track Liners. Set base against track at angle of about 45 degrees. Set bar in lower notch for first throw.

Do not move the base for second throw. Just place the bar in upper notch and in this way track will be pushed over and not lifted out of ballast.



Hackmann Combination Track Liner used with either Hackmann Combination lining or tamping bar. Base can be left in track without interference to traffic.

Hackmann Duplex Track Liner

Consisting of a Base and Removable Fulcrum. Used with any Lining Bar.

NOTE THE TWO STEP FEATURE AT TOP OF BASE

HACKMANN DUPLEX TRACK LINER

You Can Make at Least Two Pulls Without Resetting the Liner

MADE OF TWO PARTS—A TWO-STEP BASE AND REMOVABLE FULCRUM

Hackmann Duplex Track Liner used with any lining bar. Fulcrum can be removed instantly and base left in track without interference to traffic

Hackmann Railway Supply Company

723 South Wells Street, Chicago, U. S. A.

SALES REPRESENTATIVES

DU-WEL STEEL PRODUCTS CO. BALDWIN LOCOMOTIVE WORKS THE HOLDEN CO., LTD., Canada THOS. D. CROW

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Railway Engineering and Maintenance

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ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

January 21, 1929

Dear Reader:
Everywhere

I wonder if you have ever stopped to think of the rapidity with which machinery is taking the drudgery out of maintenance of way work today. Not many years ago men propelled themselves to and from work on back-breaking hand cars; today they ride in comfort on gasoline-propelled motor cars. They used to be required to lift rails into place, in relaying operations, by sheer force of man power; today rails are lifted into position by machines. In like manner, the lining bar has been replaced by the track liner, the concrete mixing platform has given way to the power-driven mixer, etc., all making work easier.

We believe in this development. We believe that it should be fostered to the end that unnecessary (and thereby wasteful) exertion should be eliminated. In other words, we believe that by the more intelligent use of machines, output can be increased and that this in turn accrues to the benefit of employer and employee alike. For this reason we have for ten years devoted the March issue to the presentation of information regarding labor saving equipment and its application to maintenance of way work. This March (or Labor Saving) issue has, therefore, become an institution.

Have you ever considered the extent to which a road is warranted as a business proposition, in investing in labor-saving equipment? Have you ever thought of the problem of maintaining this equipment most economically and at the same time so that it is ready for use when needed? In what direction do you believe that the development of labor-saving equipment will make the greatest progress during the next five years? What will be its effect on the smaller but more numerous section gangs? To what extent can the wasteful expenditure of labor be reduced or eliminated by the use of better materials?

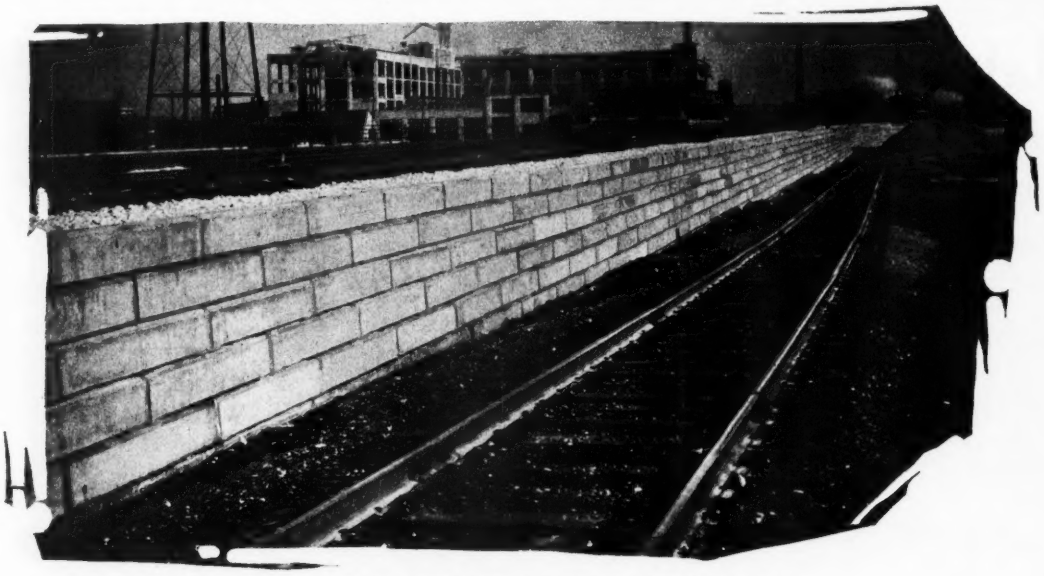
These are some of the questions that will be discussed in the next issue. I hope that you will find it of interest.

Yours truly,

Elmer T. Howson

Editor

Members: Audit Bureau of Circulations and Associated Business Papers, Inc



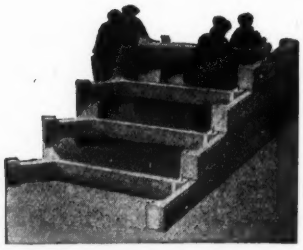
Retaining Wall of Federal 2-piece Concrete Cribbing Units for B&O Terminal

30 Carloads of Federal Retaining Wall for the B&O

The modern idea in cribbing construction has taken hold fast. Two-piece design with its saving in material and erection costs — speedy installation in any weather — its clean-cut attractive closed face — freedom from maintenance — 100% salvage when moved—all these are advantages that railroad engineers have been quick to appreciate.

The B&O is but one of the many prominent roads working at this time on definite Federal wall projects. Other users include the Pennsylvania — New York Central — Northwestern — Grand Trunk — Delaware & Hudson — Boston & Maine.

Our book "The Ideal Retaining Wall" gives details. Sent on request.



Note the Y-shaped headers which interlock with the stretchers, holding the backfill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage.

Build in Winter!

Federal units come ready to lay and are unloaded direct from cars to wall. Erection may therefore be carried on as readily in cold weather as in summer.

FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois

Concrete Products *for Over 25 Years*

FEDERAL 2piece Concrete CRIBBING

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Railway Engineering and Maintenance

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CONTENTS FOR FEBRUARY, 1929

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Railway
Engineering and Maintenance

Volume 25 February, 1929 No. 2

Precautionary Measures

TO DATE, throughout the larger part of the country, the present winter has been the most severe of any since the memorable winter of 1917-18. While the snow fall has not, in general, been as heavy as eleven years ago, the temperature has been abnormally low for long periods. As a result, maintenance of way forces have been and are still working under more than usually adverse conditions. What future weeks will bring forth, is of course, a matter of conjecture, but the weather has been sufficiently severe to exact a severe toll on other than the best track. It is in periods such as this, that careful note should be taken of defects that appear, in order that they may not be forgotten and the application of corrective measures be overlooked later. It is also imperative that adequate precautions be taken to open ditches, entrances to waterways, etc., to provide outlet for water in the event of a sudden thaw.

It Is Not Too Early

ONE OF THE measures for the conduct of maintenance of way operations that received much more attention ten years ago than it has of late is the preparation of working programs to permit the forces to begin their activities as early as practicable in the spring and to extend them late into the fall. Born of a shortage of labor during and preceeding the war, and the resulting necessity for getting the largest possible amount of work from the force available, every effort was made to have plans prepared and materials at hand for an early start. More recently, with the passing of the necessity for such measures, there has been a tendency in some quarters to relax in this procedure and to return to the practice of giving less attention to the planning of the year's work until the season actually opens. As a result, programs for the coming season are less fully developed now on many roads than has been the custom heretofore.

This is an unfortunate tendency which will react adversely on the efficiency with which this year's work will be conducted. It is due in part to delay by the managements in passing upon the year's budgets and in advising maintenance officers of the magnitude and character of the appropriations allotted them. It is due also to a lack of insistence by maintenance officers themselves on the early preparation of their programs. The attitude of managements and maintenance executive officers alike reflects the feeling that there is no necessity for pushing the programs, because there will be plenty of labor to meet the needs this year.

However, those who assume this attitude overlook one important advantage of a long working season—that of economy. It requires little reflection to demonstrate that it costs money to organize and train a gang of men for any purpose. It is equally self-evident that as the working season is shortened, the number of gangs must be increased. Further, any increase in the force adds to the necessary outlay for tools, camp cars and other equipment, as well as to the difficulties of supervision. In other words, while the shortage of men which prompted a long working season a few years ago no longer prevails there is another and equally valid reason which leads to the same conclusion.

We are aware, of course, that the merits of this idea are recognized on numerous roads and that it is their regular practice to organize their major operations such as rail renewals and the installation and cleaning of ballast and ditching so that gangs can be moved from one division to another on programs that keep them employed from early in the spring until late in the fall. Our observation is, however, that this year, with a liberal program in prospect, plans on many other roads are less advanced than in the recent past. This is the plan-making season for maintenance of way work and it is now that maintenance officers should give full consideration to the merits of a long working season. Time lost in the spring by delay in the completion of plans can be made up only at the sacrifice of economy.

The Program for March 5, 6 and 7

THE ANNUAL convention of the American Railway Engineering Association and the year's largest and most complete exhibition of engineering and maintenance of way materials, tools and equipment are close at hand—March 5, 6 and 7. During the month which still intervenes, many railway engineering and maintenance officers will be making plans to attend the convention. Many have formed the habit of making an annual pilgrimage to Chicago during the week the convention is in session, and from the growing registration in recent years, it is apparent that this number is increasing.

In addition to the higher engineering officers, many other railway men will be looking forward to the convention and railway appliance exhibit at Chicago with a keen desire to attend. This latter group includes a large number of progressive engineering and maintenance supervisory officers, down to and including track foremen, who look to their superior officers for some suggestion which will permit them to spend a day or two in Chicago while the convention is in session. Recent years have seen increased interest among this class

of engineering and maintenance employees in the work of the A. R. E. A. and the exhibit of the National Railway Appliances Association, and more and more higher officers have become cognizant of this fact and are encouraging their men to attend. A number of officers have been making it a practice to arrange their work so that different groups of their men can be in Chicago on the successive days of the convention, and have been able to do this at little expense to their roads and with little intereference with their work.

This is a commendable practice and one which might well be extended considerably. More and more is being expected of supervisory officers in the track, bridge and building and water service departments. Their entire program has undergone modernization in recent years and they have been surrounded with modern time and labor-saving equipment from which they are expected to secure the maximum output. Under these changed conditions, it is essential that each man get in tune with and keep pace with the progress which is taking place in his particular line if he is to be the most effective in his work. The meetings of the A. R. E. A. and the exhibit offer these men the one outstanding opportunity of the year to increase their knowledge and to broaden their outlook. It is an opportunity, the value of which an engineering officer cannot afford to overlook when he is considering the program of his forces for March 5, 6 and 7.

How Much Supervision?

TO WHAT extent should a track foreman be permitted to plan his own work? One answer to this question is to be found in the insistence of some officers of track maintenance that supervisors plan the work of their gangs from day to day and issue verbal or written instructions outlining exactly what is to be done. Another is had in the comment of a certain supervisor who is required to follow this rule in directing the work of his own gangs: "When I was a foreman myself," he said, "I wanted to plan my own work and I didn't want somebody else to be interfering with my plans all the time."

It is a well-known characteristic of human nature, and one which those in managerial positions often overlook, that every man who has a spark of initiative in him likes to run his own job himself. For such men, it takes all the fun out of the work to have someone else do all the planning. We say "fun" advisedly, because no man can do his best work at any task unless he really enjoys it.

On the other hand, there is a growing feeling among railway officers that section work, as a whole, must be conducted under more thoroughly developed programs than it has been in the past, if the efficiency of this class of work is to be increased in proportion to the increase in efficiency shown in other phases of railway operation. Definite goals of accomplishment must be set up and adhered to. How the more detailed supervision which such a plan implies can be exercised without destroying the initiative of the foremen is a question that is hard to answer.

The answer is all the more difficult because of the wide range of capabilities of the foremen under the supervision of any roadmaster or supervisor. A supervisory officer must make the most of the material at his disposal, and he finds, of course, that some of his foremen carry responsibility much better than others. Some men are capable of laying out a program for a good day's work and of following it consistently; they display initiative and are capable of using their heads in emergencies. One the other hand, there are those who need minute direction; who can get a good day's work out of a small gang only if someone assigns them a specific task to be completed in a given period of time.

One fundamental rule which is almost universally observed when steps are taken to develop a program for section work, is to have the supervisor make a detailed examination of each section, in company with the foreman, for the purpose of discussing the work to be done within the period to be covered by the tentative program, and of arriving at some sort of conclusion as to what work shall be embraced in the program. The attitude that the supervisor should take in the course of such an inspection must be modified to meet the mental caliber of each foreman. If the foreman displays no interest or initiative, the supervisor has no choice but to decide for himself what must be done and take the position that the proposed schedule comprises a series of tasks which he expects the foreman to carry out. If, on the other hand, the foreman definitely assumes a proprietorship over "his section" and has well defined ideas as to the requirements, the more that he can be given to feel that the program finally adopted is his own, the greater will be the interest that he will take in it and the more he will strive to complete the work planned.

It would seem that the same principles should apply after the program has been adopted and the foremen are endeavoring to meet its requirements. For the less ambitious foreman there is no choice but to set daily tasks, whereas for the man who feels that he himself planned the work and who shows a serious desire to carry it out exactly as planned, much can be gained by exercising supervision in such a way as to insure a thorough check on the performance but with a minimum of actual interference.

Prize Awards and the Public

WITHIN recent weeks many track supervisors and section foremen have been rewarded for their effective efforts in keeping or putting their tracks in first class condition. Annual or periodic track inspections, followed by prize awards of various forms have become the rule on many roads. Supervisors and foremen appreciate the general objective of this practice—to stimulate greater effort and interest among employees, with the view of securing safer, better riding and more economically maintained track. It is a question, however, whether they fully appreciate the real underlying object of their managements in going to this trouble and expense which is, to furnish to their patrons, continuously throughout the year, the maximum of safety and comfort in transportation.

It is only natural that a foreman or supervisor should "brush up" his territory a little more aggressively at the approach of an official inspection in order to register more favorably with the inspection committee, but his ultimate aim should be to keep his tracks in such shape at all times as to make his territory register favorably with the traveling public. In other words, it should be his aim to please that larger, unofficial inspection committee composed of his railway's patrons, who are constantly riding over his track, and this cannot be done effectively by putting a veneer of perfection over the right-of-way once or twice a year.

Track men are mistaken if they think that they are

the only ones who can detect low joints or a rough riding curve, for while passengers may not know the "why and wherefore" of rough track, they are quick to sense its effects. This is true particularly of those who do much traveling and such persons are quick to express their opinions concerning the riding qualities of various roads. Comfortable riding track means more business for an individual road and more business for the railways as a whole in these days of severe competition for passenger traffic, when the public is so inclined to be critical of anything except the best. It is fine for a foreman or a supervisor to have his track rated high once or twice a year by an official committee of his road, but both foremen and supervisors should constantly bear in mind that it is more important and more to their credit to be rated high daily by that larger, always-functioning inspection committee—the patrons of their respective roads. To please the official inspection committee may win a prize, but to please the public will invariably bring its reward, and will certainly please the entre railroad.

Building to Last

FAILURES in concrete structures have been ascribed to the fact that concrete is a relatively new material of construction as compared with brick and stone masonry or wood, and that there has been a lag between the development of proper practices, through scientific investigation, and their adoption by those who actually make concrete. It was contended that good practice in the use of the older materials of construction, developed through centuries of experience, was acquired by the apprentice as he learned his trade as a mason or a carpenter, and that for this reason the chance of failure of defective work with masonry or wood construction was greatly decreased.

That there is now less confidence in the trade knowledge of the builder or the members of the trades which he employs, is evident from the efforts now being made to disseminate rules for good workmanship in the use of these older materials, based either on recent scientific investigation of a careful study of the best of practices of long standing. An illustration of this is found in the article on the framing of wooden buildings which appeared in *Railway Engineering and Maintenance* for October, 1928, page 413. An investigation, sponsored by the National Lumber Manufacturers Association, showed that the simple and long established rules for framing presented in that article were either not understood or openly ignored by many builders.

In view of the fine state of preservation of many old buildings constructed of brick and stone, one would naturally suppose that details of workmanship whereby such a high degree of resistance to the elements has become possible, would be well known and universally practiced. Yet such is not the case; too many stone and brick buildings are being built which develop defects within a few years after they are completed. A fruitful source of trouble, disintegration due to the presence of absorbed water, has been the subject of extended study by the American Face Brick Association, with the result that efflorescence—the advance warning of deterioration—has been carefully investigated. The results of this study, reviewed briefly on page 56 of this issue, disclose no cause for concern and involve no new theories. Rather, they show the need for careful observance of common sense and care in construction and maintenance.

Like methods designed to secure good results in making concrete and rules intended to insure long life and freedom from decay in wooden structures, practices which will insure freedom from efflorescence in masonry structures should be thoroughly mastered by the builder.

The Grade Crossing Problem

IF WE FACE the facts, it is evident that the grade crossing problem will confront the railroads for many years to come. This is not a cheerful outlook for those in the maintenance of way department who see in the grade crossing a large amount of trouble and expense, and constant cause for apprehension. It is true that the number of grade crossings will probably be lessened somewhat by elimination and grade separation, but these factors will be offset by the increasing development of the country and the ceaseless demand for additional crossings, unless the railways are ever vigilant in opposing at the outset every additional crossing for which there is no overwhelming necessity and no alternative. The real solution of this problem today, after every effort has been exhausted to eliminate unnecessary crossings and to combine others by connecting or relining streets and highways, is to make every existing crossing as safe as possible and to educate the public thoroughly in safe crossing practices. Herein lies a serious task for maintenance of way forces.

On a following page of this issue there appears a description of the grade crossing problem and the manner in which it is being solved on the Long Island, which is of interest not only because of the acuteness of the problem on this relatively short line, but also because of the length to which it has been necessary for this road to go in affording crossing protection. Within the Metropolitan area of New York City alone, the Long Island has 359 public grade crossings, practically all of which are of first importance owing to the heavy highway traffic and the dense high-speed, multiple-track train operation over them. At many of these crossings as many as seven different means of warning and protection are provided, including a crossing watchman, a policeman, gates, a warning bell, an annunciator system, a standard crossing sign and an advance warning sign. At many other crossings, from four to six different means of protection are not uncommon. It is costing this road approximately $175,000 annually for grade crossing maintenance alone, in addition to expenditures of more than $1,000,000 for crossing watchmen and crossing policemen. In spite of all this expense and the elaborate protection afforded, about 350 crossing gates are damaged or broken yearly by careless or reckless motorists. This emphasizes the magnitude of the problem confronting maintenance of way forces, upon whom falls the brunt of the work and worry of grade crossing maintenance and protection.

New Books

Practical Color Simplified, by William J. Miskella. 114 pages, illustrated in color, 6 in. by 9 in. Price $3.50. Published by Finishing Research Laboratories, Inc., 1164 West Twenty-second street, Chicago.

The layman will find this book of value for the practical ideas it will give him on the principles of color harmony. The practical painter will find that he will gain a more systematic knowledge of colors; what he already knows will be confirmed and put into a logical order. The author has not only presented a concise outline of the principles of colors and their combinations, but he also offers practical examples of their application. A chapter on the properties of common pigments will also be found of value.

Treating a Low- Saves $48,000

Rock Island reconstructs its facilities to provide an adequate supply for engine terminal and shops

The Water Softener is of Unusual Size

A WATER softening tank with a capacity of 900,000 gal., for the treatment of water containing only 14 grains of hardness, an intake well equipped with a traveling screen, and electrically-operated apparatus for recording and indicating the discharge of the pumps and their remote control, are distinctive features of new water supply and treating facilities recently completed by the Chicago, Rock Island & Pacific at Silvis, Ill. It is also of interest that sodium aluminate is employed as a reagent in the treatment to supplement the use of lime and soda ash. The improvements at Silvis comprise replacements and additions to an old plant for the purpose of increasing the supply and improving the quality of water required for the operation of the system shops and storehouse and the engine terminal and yard located at that place.

The source of supply, the Mississippi river at Watertown, about two miles from Silvis, afforded water heavily laden for a large part of the year with suspended matter that was constantly filling up the intake well and gave rise to the construction of a concrete reservoir or settling basin of 1,000,000 gal. capacity, which was employed also as a cooling basin for the condensers of the shop power plant. However, the demand for water was so large, relative to the storage capacity, that the settling time was not long enough to be thoroughly effective.

The old pumping plant at the river consisted of two double-acting triplex 9-in. by 10-in. pumps, one driven by an Otto gasoline engine 25 years old and the other by a 50-hp. electric motor, the second unit serving as a stand-by. With increasing demands for water, this equipment proved inadequate, conditions being complicated by the increasing friction head imposed by the old 10-in. pipe line 9,600 ft. long which extended from the pumping plant to the settling basin. From the latter point the water is delivered through the distributing system by pumps located in the power plant. To equalize the pressure and provide a reserve supply for fire protection, a 100,000-gal. steel tank is installed on a 100-ft. tower as seen in one of the illustrations.

Soften Low-Hardness Water

A further defect in the service arose from the fact that the old plant did not include facilities for softening the water, for while the content of incrusting solids, 14 grains per gallon, is moderate, the quantity of water used is so great that the economies to be effected by the removal of incrustants clearly justified the installation of treating facilities,

The Pump House is Equipped with Two 5-in. Centrifugal Pumps Driven by 75-hp. Motors

Hardness Water per Annum

Improvement includes treating plant of unusual size and the installation of a traveling screen in intake well

particularly as these could be designed so as to effect a marked improvement in the clarity of the water as well.

The improvement project included the installation of new pumping equipment, the reconstruction of the intake well and the erection of a water treating plant with a capacity of 100,000 gal. per hour. Consideration was given to the replacement of the delivery pipe line, but tests showed that the expense of providing a new pipe line would more than offset the saving in power consumption to be obtained by reason of the lowered friction head. Consequently it was decided to develop pumping facilities to meet the requirements imposed in pumping through the old pipe line.

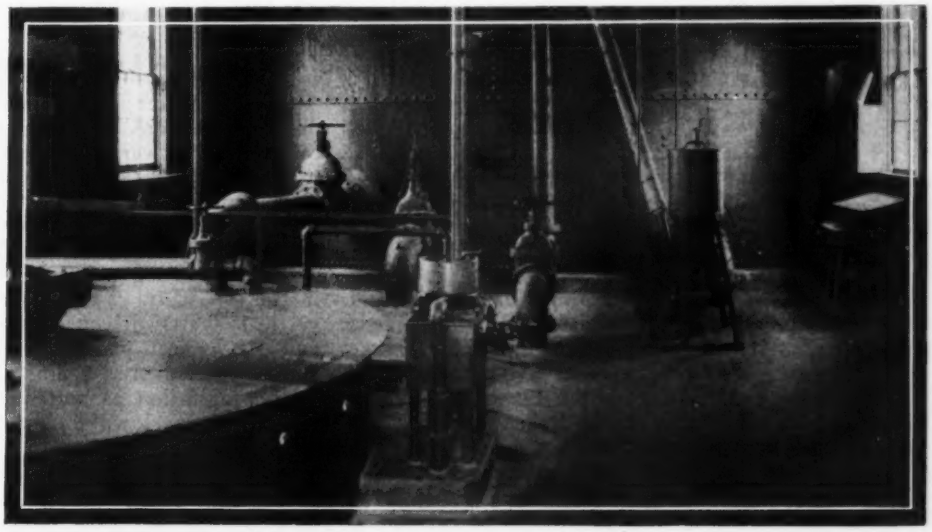
To determine the proper pump design, tests were run with the old equipment. A record was taken of the pressure developed with the discharge from the engine-driven pump, as computed from its displacement and checked with a weir at the reservoir. Similar records were taken with both pumps running and from the change in pressures noted with the change in discharge, it was possible to determine what the head would be for the desired rate of discharge (1,100 g.p.m.) for the new pumps and to determine the required characteristics of the pumps. This indicated a five-inch centrifugal pump driven by a 75-hp. motor. Two units were installed and cross-connected to pump singly or in stage. By

The Operating Head for the Moving Intake Screen

pumping in stage, sufficient head is gained to pump directly into the fire protection tank on the high tower whenever this is necessary.

Moving Screen Cleans the Water

To eliminate suction-line trouble, the old intake well, which consisted of a circular brick wall on a wooden crib, was cleaned out and lined with concrete and the walls extended above high-water level. However, the most important change was to install a traveling screen, which serves the double purpose of straining the water before it reaches the pump intake and also removes the debris from the well. It consists of screen panels 30 in. wide, made of No. 12-gage wire with ⅜-in. openings, set in the links of a large endless sprocket chain that is hung in a



In the Treating Plant, Showing the Chemical Control Apparatus and the Treating Tank

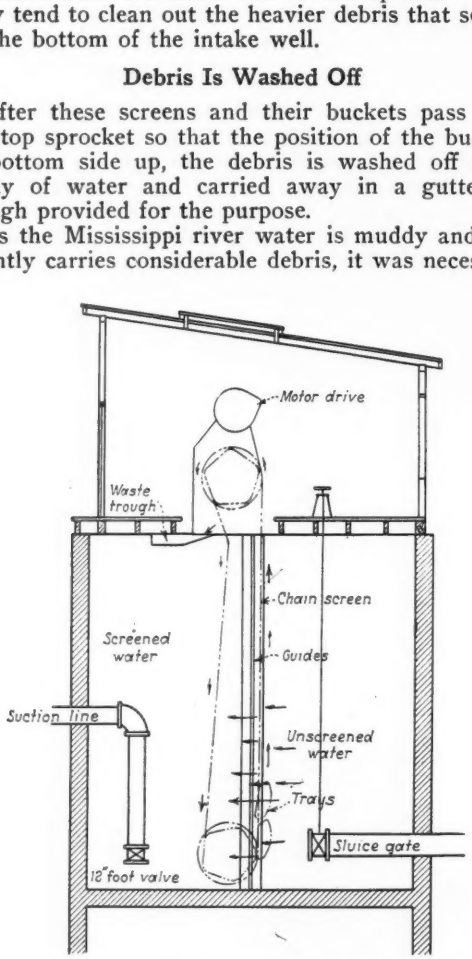
vertical position in such a way that it just fills a gap provided for it in a partition wall built across the well.

This screen chain passes over an idler sprocket at the bottom of the well and another sprocket at the top that is geared to a three-horsepower motor so that the screen is moved at the rate of 10 ft. per min. The screen moves up on the side of the well into which the water is delivered from the river; consequently the screen tends to carry up and out of the well floating matter that is brought against it by the water flowing through it. This action is made more effective by buckets which are provided at the bottom of each panel or link of the screen chain. These buckets catch the larger masses of debris that are stopped by the screen but do not stick to it. They also act as excavating buckets at the bottom of the well as they are carried around the bottom sprocket from the down run to the up run. Thus they tend to clean out the heavier debris that settles to the bottom of the intake well.

Debris Is Washed Off

After these screens and their buckets pass over the top sprocket so that the position of the buckets is bottom side up, the debris is washed off by a spray of water and carried away in a gutter or trough provided for the purpose.

As the Mississippi river water is muddy and frequently carries considerable debris, it was necessary



Section of Intake Well Showing Moving Screen

to clean the old pit several times each year, and this work, together with danger of water failure, is now eliminated. To prevent clogging of the intake line from the well to the river, a back-wash line was installed so that water from the reservoir may be turned back into this intake or drift line to wash out the mud that settles in it.

A flow meter was installed in the discharge line from the pumps to the reservoir to measure the water pumped and also to provide an indication to the power plant engineer, who starts and stops the pumps by remote control from the power house which is about two miles from the pumping plant. The meter consists of an orifice plate inserted in the discharge line near the reservoir. This orifice creates a differential pressure, which is carried to a meter body through copper tubes which causes a corresponding rise or fall of mercury in the bottom of the meter body. This mercury, in rising, makes contact in succession with the ends of a series of rods of varying lengths. Therefore, the height of the mercury determines the number of rods it touches, and as each rod is connected with a given resistance, the height of the mercury determines the resistance and therefore, the volume of the current

The Pump House

in the circuit. The meter body is filled with high tension transformer oil above the mercury to insure durability of the resistance element. The electric current thus determined is carried to the instrument board, located in the power house 500 ft. away. This board is provided with three instruments, a recording gage, a totalizing gage recording the total amount pumped, and an indicating gage. The latter is especially valuable because it shows the operator who starts the pumps whether or not they are properly primed and delivering water at the pumping station.

A Large Treating Plant

The raw water is rehandled from the reservoir to the elevated tank with pumps operating automatically in the power house and then flows by gravity to the treating tank. The treating tank is 50 ft. in diameter by 62 ft. high and encloses a downtake 12 ft. in diameter. The total capacity of this tank is 900,000 gal.—one of the largest in the country used for treating purposes. Agitation is provided in the top 40 ft. of the downtake by means of two vertical shafts driven through gears by a 5 hp. motor. Twenty paddles are hung on these vertical shafts and revolve against each other to provide further agitation as water passes through the top portion of the downtake.

The raw water supply is controlled by a float valve and passes through a weir box, where a small proportion is taken to the tipping meter, which in turn lowers the suction line in the chemical vats,

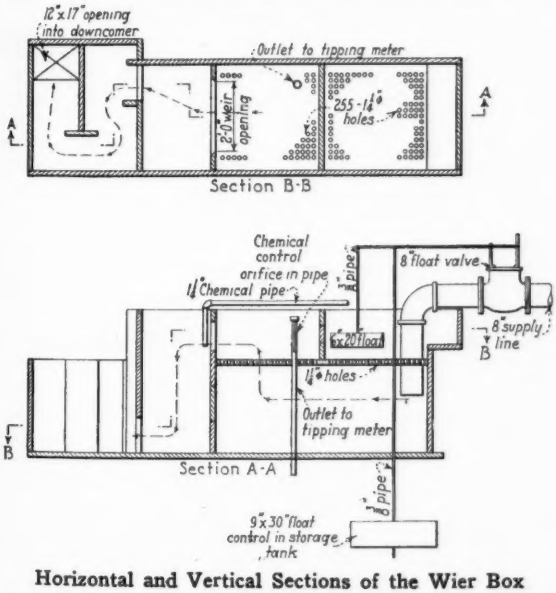
to control the proportion of chemical delivered. This float valve also operates the switch to the various motors so that the downtake agitation, chemical pump, chemical vat agitators and the sodium aluminate feeder are started and stopped by the flow of water through the weir. The chemical mixing tank is 10 ft. in diameter by 5 ft. high, with a pre-mixing vat 5 ft. in diameter by 3 ft. high, and is agitated through a reduction gear, by a 3 hp. motor. A 2½-in. by 2½-in. triplex pump direct connected to a 1-hp. motor handles the lime and soda ash mixture.

Saves $48,000 Annually

A sodium aluminate dry feeder of the fan type is provided to discharge dry sodium aluminate into the downtake near the weir. The pipe line from the blower to the top of the tank is insulated with pipe covering, and heat is applied to the fan table by electricity to prevent moisture entering the line and causing the dry aluminate to incrust the fan or discharge line.

Sodium aluminate is added to speed up reaction, assist in clarification of the supply, reduce residual hardness to a minimum and guard against after precipitation in the pipe lines. Hardness tests made since the plant has been in operation show that the treated water contains about 1.5 grains of incrustants per gallon. This is consistent with the results anticipated, and reflects the accuracy of the proportioning device and equipment used. According to the A. R. E. A. formula, the plant shows an annual net saving by reason of treatment in excess of $48,000.

Sludge is removed through a double grid with two 10-in. quick-opening valves into a pit at the



Horizontal and Vertical Sections of the Wier Box

edge of the tank and is drained away by a 15-in. sewer.

The treated water take-off is of the telescopic floating type, made of Armco iron pipe, with a 12-in. riser 21 ft. high at the bottom, then a section of 14-in. pipe 20 ft. long, followed by a top section of 16-in. pipe 18 ft. long, supported by a float 5 ft. in diameter by 2 ft. deep. The float and pipes are guided in their vertical movement by four cables. This insures that the water entering the supply system is taken from close to the surface of the water in the tank, which has, therefore, had the longest reaction time.

Instead of a concrete base, the tank is supported on a crushed stone fill retained by a reinforced concrete ring wall. This serves as an especially good footing as it provides a satisfactory drain under the bottom plate of the tank and is economical in construction.

The pumping and treating plant was designed and erected by the Railroad Water & Coal Handling Co. under the supervision of P. M. LaBach, engineer water service, and A. C. Bradley, division engineer (now district engineer maintenance of way) of the Rock Island.

More Awards Reported

SUPPLEMENTING the reports of prize awards made by eight railways, appearing in the December and January issues, we present below summaries of the awards made by four other roads. These are the Chesapeake & Ohio, the Erie, the New York Central (Buffalo and East) and the Southern (Lines East). Reports on other railways will appear later.

C. & O. Rewards Supervisors and Foremen

The annual track inspection of the Chesapeake & Ohio for 1928 was carried out on much the same basis as the inspection for the previous year, which was described fully in *Railway Engineering and Maintenance* for January, 1928. One of the units of the inspection train is a special car fitted with equipment which makes a graphic record of low joints, gage, cross-level and train speed.

In establishing the final ratings to be applied to the various sections of the road, the records of the inspection car are given a weight of 60 per cent, and the gradings made by the inspection committee, a weight of 40 per cent. In interpreting the record obtained from the special inspection equipment, a system of grading is used whereby demerits, valued in terms of per cent are applied for low joints and irregularities in surface.

For the purpose of making prize awards, the entire system is divided into the four following groups according to the class of track and tonnage handled: Group I—double-track main line, freight and passenger traffic; Group II—single and double-track main line, principally freight traffic; Group III—single-track main line, principally passenger traffic; and Group IV—secondary branch lines.

In each of these groups a first prize of $50 and a second prize of $25 is awarded to the supervisors whose subdivisions receive the highest weighted average, with corresponding prizes of $25 and $15, respectively, to two foremen on each supervisor's subdivision. A prize of $50 is also given to the subdivision on the system which has shown the most improvement during the year, the extent of the improvement being based solely upon a comparison of the records made by the inspection car with similar records of the previous year.

As a result of the inspection for 1928, the following supervisors were awarded prizes: Group I—first, J. L. Brightwell, Huntington subdivision; second, J. H. Arthur, Cincinnati subdivision; Group II—first,

J. F. Painter, James River subdivision; second, James Broshears, Columbus subdivision; Group III—first, R. H. Gibson, Mountain subdivision; second, S. Ryan, Chicago subdivision; Group IV—first, B. Jackson, Whitesville subdivision; second, W. L. Bennett, Loup Creek subdivision. The system improvement prize of $50 for the year was awarded to W. L. Bennett, who also won the second prize of the general inspection for Group IV.

N. Y. C. Awards Prizes in Monthly Premiums

In making its annual track inspection, the New York Central (Buffalo and East) follows a plan, devised several years ago, of dividing its tracks into classifications, and then subdividing the classifications into groups, each group within the different classifications containing only sections similar in character, in order that all foremen may have the same opportunity in competing for the prize awards offered.

Unlike most other roads distributing prize money, the New York Central makes its awards in the form of premiums which are added to the regular compensation of the winners. Under this plan, the foremen who receive the highest ratings in their respective groups are awarded monthly premiums of $5 throughout the year, and similarly, the foremen receiving the highest ratings in each classification are awarded additional monthly premiums of from $2 to $3. In addition to these premium awards, cash awards of $10 gold pieces are made to the foremen who have received the highest marks in their respective groups for four or more consecutive years.

The foremen winning the classification prizes for 1928 are as follows: Classification 1, John Andros, Subdivision 3, Eastern division; classification 2, E. Teats, Subdivision 27, Pennsylvania division; classificaton 3, M. Duquette, Subdivision 9, Adirondack division; classification 4, D. De Nardo, Subdivision 12, Rochester division; classification 5, J. Crzybeck, Subdivision 13, Buffalo division.

The highest average rating given to any subdivision, was 85.6, this being awarded to Subdivision 10 of the Syracuse division, of which W. N. Skelton is supervisor. The second and third highest subdivision ratings were 85.4 and 85.1, which were given respectively to subdivision 13 of the Buffalo division, of which T. J. Sexton is supervisor, and to subdivision 13-B, of the same division, of which J. P. Sexton is supervisor. All three of these subdivisions, with the same supervisors, were winners of similar awards in 1927.

The highest division rating for the year was given again to the Buffalo division, its rating being 85.3, while the second highest division rating of 83.9 was given to the Syracuse division. The general average rating for the road (Buffalo and East), was established at 83.5, which is slightly above the similar ratings of 83.2 given in 1927, and 83.0 in 1926.

Erie Awards $9,850 in Prizes

The annual inspection of the tracks over the three districts of the Erie is made by the special track inspection car of that road, which records cross-level, high and low joints, gage, and lurches due to track conditions, and by a special inspection committee which supplements the mechanical record by rating each section upon the condition of line, ditches and policing. The prizes awarded for 1928 included first prizes of $200 and second prizes of $100 which were given to those supervisors on each of the three districts of the road whose subdivisions received the highest and next to the highest ratings, respectively; 13 "Banner" prizes of $150 each, which were awarded to those foremen whose sections received the highest rating on each division; and 44 first prizes of $100, and 32 second prizes of $75, which were given to the foremen whose tracks obtained the highest and second highest ratings on the different subdivisions.

In determining the winners of the various prizes, the combined rating of the inspection car and the committee for each section or territory is adjusted downward or upward depending upon whether the territory under consideration has employed greater or fewer man-hours during the working season, than the number which had been allowed. The final rating thus established determines the prize winners, except that an excess number of low joints found on any foreman's or supervisor's territory, bars him from consideration for the prizes. In the case of the section foreman, the total number of low joints found on his section can not equal or exceed an average of one per mile on main-line track or two per mile on branch-line track, and in the case of the supervisor, the total number of low joints on his subdivision cannot equal or exceed an average of one-half per mile of main line or one per mile of branch line.

The total awards to supervisors and foremen in 1928 amounted to $9,850, the supervisors' share of this amount being divided as follows:

Division	Amount
New York District, Main Line	
New York—C. L. Connors	$200
New York—W. H. Wahl	100
New York District, Branch Lines	
N. Y. S. & W.—C. A. Joyce	$100
Eastern District, Main Line	
Susquehanna—W. E. Stenson	$200
Alleghany—W. H. Connolly	100
Eastern District, Branch Lines	
Tioga—J. J. Leonard	$100
Western District, Main Line	
Marion—A. Burgett	$200
Kent—N. E. Scribner	100

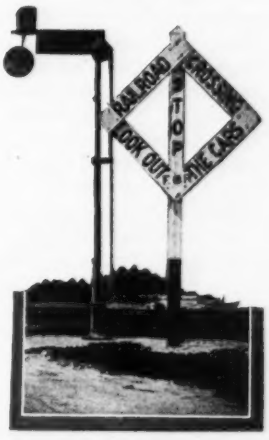
Southern Rewards 140 Foremen

The annual track inspection of the eastern lines of the Southern again assumed its usual importance in 1928, after having been restricted somewhat in 1927 owing to the pressure of construction and maintenance work at the time of the annual inspection for that year. During the 1928 inspection, definite grades were established for each class of maintenance work, and ratings were determined for each unit of the system, starting with the individual section foreman's territory as a basis.

In past years it has been the policy of the Southern to award motor cars to those first prize winning sections not so equipped, and to award $20 and $10 gold pieces to those section foremen who are entitled to second and third prizes. During the past year however, sufficient motor cars were purchased to fully equip all section and extra gang forces on the road, so that motor cars were eliminated from the prizes in 1928 which were confined to first prizes of $20 and second prizes of $10. As a result of the 1928 inspection, 140 foremen in the track, and bridge and building departments of the Southern, Lines East, were awarded prizes for the general excellence of their work throughout the year.

Meeting the Challenge of the Highway

Long Island installs from four to seven means of protection and warning at 290 crossings at a total expense of $1,190,000 annually



AMONG the problems confronting the Long Island Railroad in providing the people of Long Island with fast, dependable and safe transportation, one of the most outstanding, and one to which it gives a large amount of attention, is that of grade crossings, including grade crossing maintenance and protection, and the education of the public in safe practices at grade crossings.

With a total of only 397 miles of lines, this road is crossed at grade approximately 600 times by public highways or other public thoroughfares and, in addition, is crossed by about 305 private roads or driveways, including some used publicly. More serious, 359 of the public crossings are located within the metropolitan area of New York, in the Boroughs of Brooklyn and Queens, and in Nassau county, where multiple tracks are the rule, where train service is frequent, and where vehicle and pedestrian traffic is dense.

An idea of the frequency of train traffic in this area is best evidenced by the record of June, 1928, which, while slightly higher than the average throughout the year, shows that the Long Island operated over its lines a total of 30,002 regularly scheduled and 3,046 extra trains during that month. Most of these trains were in high-speed, steam and electric commutation service to and from New York City, and practically all of them operate in and out of the metropolitan area on a multiple-track system of from two to eight tracks, where highway traffic at crossings is the heaviest. At many of these crossings, this class of traffic is so dense as to be practically continuous, thousands of vehicles crossing the tracks daily, in addition to thousands of pedestrians.

Many Crossings Have Been Eliminated

With such conditions prevailing, brought about mainly by the increasing use of motor vehicles and the rapid development of the Island, particularly in the territories served by the railroad, the Long Island is confronted with what is probably the most severe crossing problem in the country. The railway recognizes the severity of this problem, and, as outstanding as the problem itself, is the effort made by the road to eliminate grade crossings, to make the remaining grade crossings safe, and to educate the public and its own employees in crossing safety practices.

The elimination of grade crossings is considered by many as the ultimate solution of the grade crossing problem, and yet, a solution which, because of

Educating the Public at One of the Long Island's Overhead Crossings

its magnitude, can be effected only over a long span of years, and then only with the close co-operation and assistance of civic authorities and the public. The Long Island fully recognizes the value and effectiveness of grade crossing elimination, and has lent its effort in this regard. This is evidenced by the fact that, with only a few exceptions, more grade crossings have been eliminated on this road during the last 15 years than on any other road in the country. Similarly, in proportion to mileage, it has expended more money for grade crossing elimination during this same period than any other road in the country, the total expenditure exceeding $20,000,000. As a result, there are now 349 public highway and pedestrian crossings on the Long Island where highway and street traffic is entirely separated from rail traffic. At 147 of these crossings, rail traffic is carried overhead, while at the remaining 202, the railroad tracks extend under highway and foot bridges.

Further evidence of the road's interest in grade crossing elimination is shown by the fact that it is now completing plans for a grade crossing separation project at Jamaica, N. Y., wherein eight tracks will be elevated through a distance of about 5,000 ft., crossing over five heavily-travelled streets. This work, which is expected to be started in the near future, is estimated to cost in the neighborhood of $6,000,000, and will require about two years for completion.

Supplementing efforts for grade crossing elimination by track elevation (depression, generally speaking, being impracticable on Long Island because of ground water) and by elevating or depressing highways, which of necessity will proceed slowly owing to the extensiveness of the work and the magnitude of the expenditures involved, the road has insisted upon the closing of unnecessary crossings and the combining of others, and has opposed the opening of additional grade crossings unless public convenience and necessity demand and there is no alternative.

Heavy Protection at Important Crossings

While the elimination of grade crossings constitutes one of the most important phases of the Long Island's crossing problem, the paramount phase of this problem is the maintenance of its existing grade crossings and the protection of the public using them on both trains and highways. That this is recognized by the Long Island is evidenced by the extensiveness of the protection which it affords at the more important crossings, and the amount which it spends for crossing protection and maintenance.

Of all the public grade crossings on the road, 23 are protected by watchmen or flagmen, gates, bells and signs; 175 by watchmen, gates and signs; 15 by watchmen and gates; 32 by gates, bells and signs or gates and signs, the gates being operated by watchmen in charge of other crossings; 14 by watchmen, bells and signs; 31 by bells, flashing-light signals and signs; 45 by bells and signs only; 18 by watchmen and signs only; and 292 by signs only. Other crossings not included in the above are protected by watchmen, gates and bells, watchmen only, or bells only, while in many instances, crossings are protected by wig-wag or flashing-light signals in addition to the other warning devices which may be in service. In all, there are 251 crossing gate installations and 735 crossing watchmen on the road. The extent to which the gates are used is evidenced by the fact that 220 of them are maintained in operation 24 hours each day, while practically all of the remaining gates are attended during the two shifts from 6 a.m. to 10 p.m.

In addition to this extensive protection, practically every crossing has a standard warning sign 300 ft. in advance of the crossing on each side. Further, 63 of the most heavily travelled crossings, in addition to being provided with watchmen, gates, and warning devices, are further protected by trafficmen, in police uniforms, who are commissioned New York State police officers. Track circuits control all automatic warning devices, which give warning of approaching trains when they are at least 1,000 ft. in advance of the crossings, and supplementing this, in order to preclude a man-failure where traffic is the heaviest, 90 of the crossings are linked by an annunciator system operated through a bell code. Thus, a large number of crossings are protected by seven means of warning in an effort to make them as safe as is possible. Other means of adding to the comfort and safety of the public at its crossings include careful attention to the maintenance of crossing pavement and the removal of all surface obstructions in the vicinity of crossings which might impair a clear view of approaching trains.

The Expenditure Is Enormous

The exact total cost of this extensive crossing maintenance and protection has never been computed inasmuch as it involves, aside from the direct items of expense, many auxiliary items such as the part-time assistance of the engineering and signal departments and of the section forces, which cannot readily be segregated and reported. Sufficient, however, to indicate the magnitude of this expense, is the fact that crossing maintenance alone on the Long Island for the last three years has cost from $173,000 to $188,000 annually, and manual crossing protection has cost from about $1,000,000 to $1,080,000 yearly.

Among the many crossing protection devices in use on the Long Island, there are a number of distinct types and classes, this being brought about largely through the gradual development of more effective devices, and an effort on the part of the road to install the most suitable and up-to-date equipment available when the need for additional equipment arises. All of the crossing gates in service are of either the single-arm or double-arm type, and all except two sets of gates are manually operated, this type of gate having been found well adapted to the requirements of the various crossings on the road. The two gate installations not controlled manually, are of the electro-pneumatic type. Practically all of the gate installations are operated singly; however, there are a few instances where the gates are controlled by a watchman in charge of two crossings.

All of the newer flashlight signals on the road are of the Signal Section, A. R. A. design, with two lights placed horizontally on the mast, but a number of the older installations consist of smaller diameter flashing lights mounted either horizontally or above one another. The warning bells in service are a number of different types, all designed however, to effect the same result, while the sign at each crossing is the standard diamond-shaped frame structure required in New York State.

Where watchmen are maintained, they are considered the backbone of the protection afforded, it being their sole interest and duty to protect lives

and property on the crossings, taking all measures that may be necessary to that end. While much is left to their discretion in handling unusual conditions which arise, all of their regular duties and rules for their conduct are carefully defined in a set of instructions which are posted prominently in each watchman's house or shanty. These instructions, which include 26 items, are the result of years of experience in crossing protection and a careful study of what should be the conduct of watchmen under all conditions.

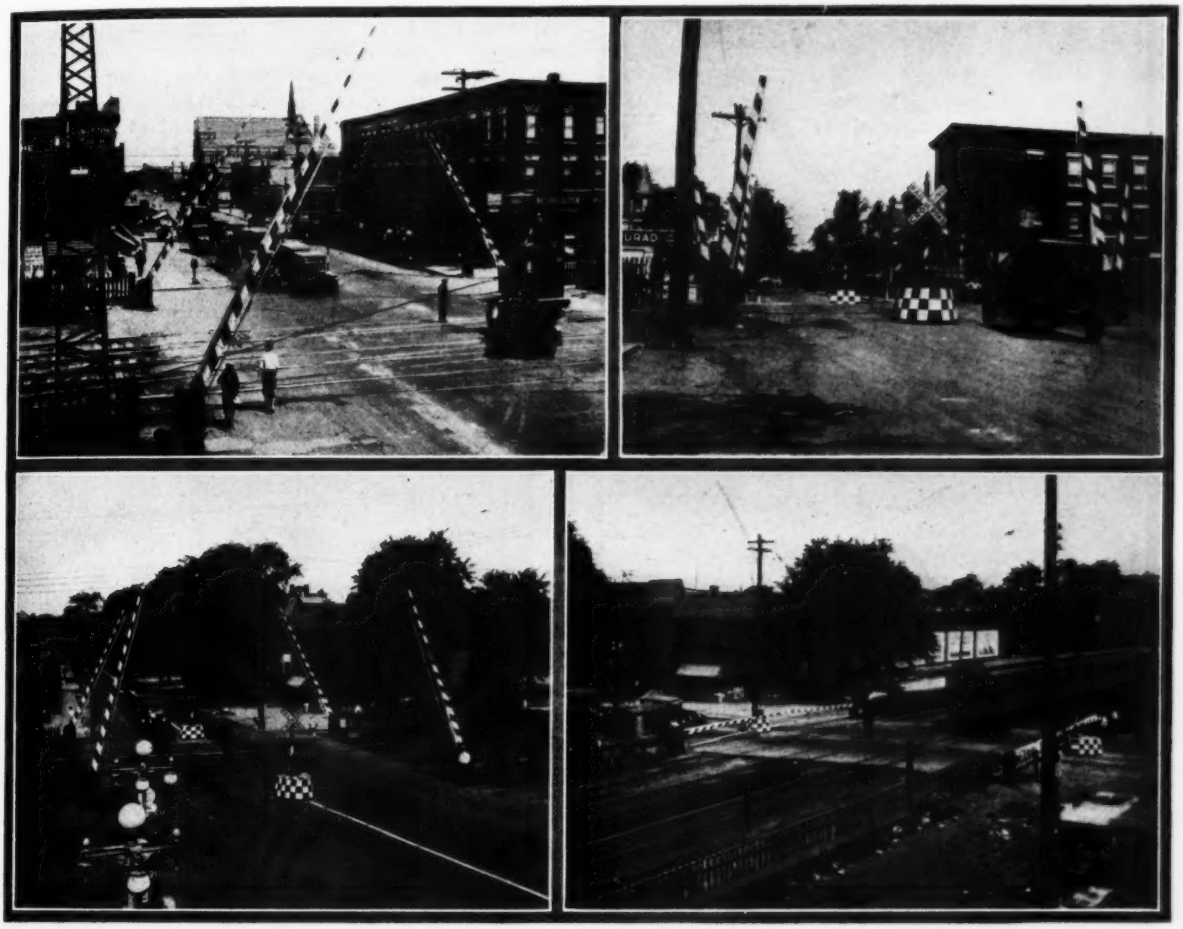
The equipment issued to each crossing for the use of the watchman on duty consists of a book of rules, a hand "Stop" disc, two red flags properly mounted on staffs, one white lantern, two red lanterns, several fusees, and one pair of gate lamps for each set of gates. The instructions govern the use of this equipment during both day and night and in all cases of emergency.

The trafficmen assigned to crossings where conditions are unsually severe are in every sense additional watchmen clothed with police authority, assigned to assist in protecting the crossings. As in the case of the watchman, all of their duties and rules of conduct are well defined in a set of instructions which are posted at each crossing. In the main, their duties are supplementary to those of the watchman, so as to insure the close co-operation of the two men at the crossings. In other respects, however, their duties are of a more or less supervisory nature, in that they require the trafficmen to direct a number of the activities of the watchmen, and to see that proper equipment is always on hand in the watchmen's houses.

The normal position of the trafficman is in the center of the crossing, visualizing in all directions. On the approach of a train, he blows one blast on a whistle as a signal to the watchman to lower the crossing gates, it being required that this shall be done in sufficient time to permit the placing of the gates in the fully closed position before trains are within 1,000 ft. of the crossing. After a train has passed, and the trafficman assures himself that there are no trains approaching in either direction, he blows two blasts on his whistle as a signal for the watchman to raise the gates.

Both the watchman and the trafficman at the various crossings have their individual houses or shanties, it being standard practice, wherever possible, to locate them diagonally opposite each other, on opposite sides of the tracks. Ordinarily the shanties are placed at the ground level, but where necessary, in order to afford clear visibility of both the tracks and the crossings, such as near high station platforms or where the watchman is located at an intermediate point controlling two crossings, the houses are placed at a higher level on frame towers.

All of the shanties are of standard design and of frame construction, with an inside area of 4 ft. by 5 ft. In some instances, a canopy is provided over the



A Total of 251 Crossings Are Protected by Gates

Six Forms of Protection Are Provided at Some Crossings

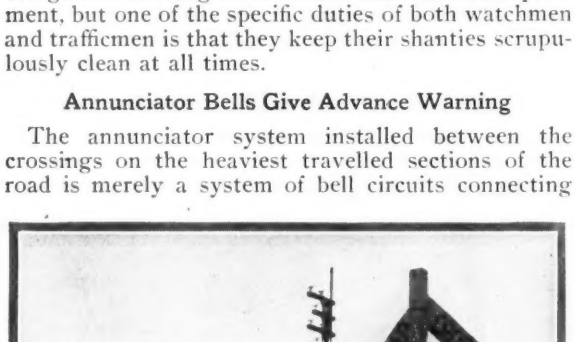
A Tower Watchman Operates the Gates at This Crossing

Four-Track, High-Speed Traffic, but Fully Protected

entrance to the shanty to afford the watchman some protection in inclement weather while operating the crossing gates. The shanties are maintained by the bridge and building forces of the maintenance department, but one of the specific duties of both watchmen and trafficmen is that they keep their shanties scrupulously clean at all times.

Annunciator Bells Give Advance Warning

The annunciator system installed between the crossings on the heaviest travelled sections of the road is merely a system of bell circuits connecting



What a Little Effort Has Done at a Watchman's Shanty

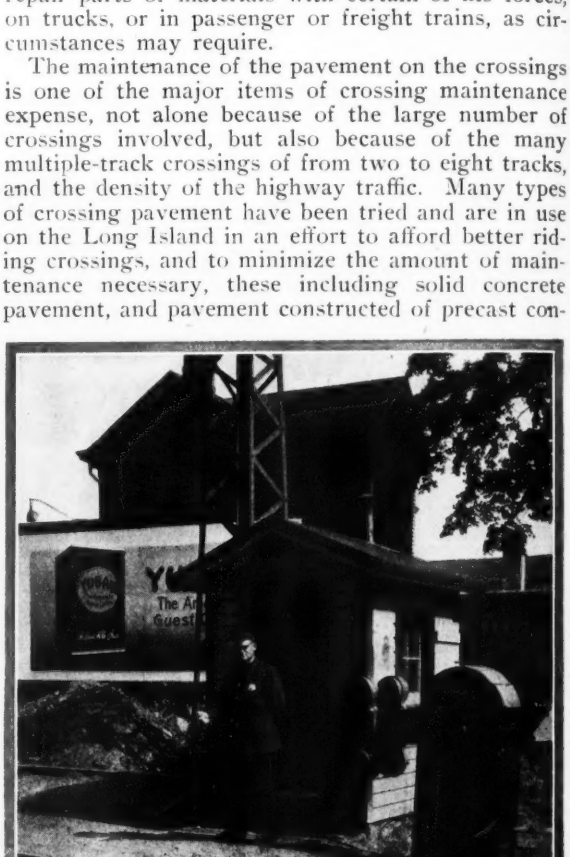
adjacent crossings, with push buttons and bells located in each watchman's shanty. Through this system, which employs a simple bell code, each watchman is in direct communication with the crossing watchman on each side of him, and is required to warn them of the approach of trains, and of any special conditions which might affect the situation at their crossings. As soon as the annunciator message is received, the watchman receiving it acknowledges it in code, and in due time passes the message along if it affects the crossings beyond him.

Maintenance of the crossings and of all of the crossing protection equipment and devices is in direct charge of the maintenance of way department. Like the practice on most roads, all electrically-operated crossing warning devices are maintained by signal forces, all watchmen's and trafficmen's shanties, and all crossing gates are maintained by bridge and building forces, and all crossing pavements and the 130 sets of farm gates on the road are maintained by the track forces.

In the maintaining of crossing gates, a foreman and a gang of from 14 to 16 men are assigned to this work constantly through the week, with a special gang to take care of gate repairs on Sundays. By far the greatest amount of the work of these gangs is repairing gates which have been broken or damaged by motorists. This is evidenced by the fact that, in spite of the care exercised constantly by the crossing watchmen in lowering their gates, about 350 gates are run through and either damaged or broken each year, or an average of about one set of gates a day.

When gates at a crossing are damaged, the watchman telephones the division engineer's office as soon as possible, making a preliminary report of the case and indicating the extent of the damage. The crossing gate foreman is then notified and makes prompt arrangement for repairs, sending out the necessary repair parts or materials with certain of his forces, on trucks, or in passenger or freight trains, as circumstances may require.

The maintenance of the pavement on the crossings is one of the major items of crossing maintenance expense, not alone because of the large number of crossings involved, but also because of the many multiple-track crossings of from two to eight tracks, and the density of the highway traffic. Many types of crossing pavement have been tried and are in use on the Long Island in an effort to afford better riding crossings, and to minimize the amount of maintenance necessary, these including solid concrete pavement, and pavement constructed of precast con-



Each Trafficman Has a Police Uniform and a Shanty

crete slabs, planking, bituminous mixtures, and a number of other materials. The standard crossing pavement of the road is, however, a combination of planking and a special asphalt mixture, the asphalt being used between the rails and in the inter-track space, between heavy planking which lines both sides of each rail. The asphalt material used is of the type which is applied cold, this material being secured in small lots as needed.

Safety Promotion Plays Large Part

Supplementing the extensive care and protection afforded grade crossings on the Long Island, and of no less importance, is the safety work which the road is promoting in a constant effort to educate both its employees and the public in crossing safety. This

particular work is under the direction of a system supervisor of safety and is carried out mainly through local safety committees, which cover every section of the road and represent every department. These committees have regularly scheduled meetings, at all of which all phases of safety are given consideration.

With grade crossing safety of so much importance, much of the effort of the safety committees is directed along this line. This includes group meetings of the watchmen and trafficmen, where their problems and safety measures are discussed, constant unofficial observation of all crossings, and an annual official inspection of all crossings. These inspections of the safety men are supplemented, of course, by the regular periodic inspection given to all crossings by section foremen and track supervisors.

Annual Inspection by Safety Men

At the annual inspection of the crossings, which is made in connection with the annual national "Careful Crossing Campaign" of the railroads, certain of the safety committeemen are assigned to each of the more important crossings, and not only make thorough observation of all physical conditions and the manner in which the crossings are protected, but also make a careful check of all traffic using the crossings. In this latter respect, a traffic count is made over a period usually of from six to ten hours, and a record is made of all motorists who either exercise unusual caution in crossing the tracks, or who exercise little or no caution. In each case, the speed of the vehicles over the crossing, and any special circumstances, are reported, so that, to a certain extent at least, the Long Island has a record of those who use its crossings, both cautiously and recklessly.

Another means of increasing crossing safety employed on this road is through intensive campaigns of public education which involve principally, safety literature, posters, signs, and safety talks. All of these efforts are effecting results in a number of ways, not the least of which is the increased spirit of cooperation which is being manifested on the part of the public. This is evidenced by a careful estimate made from records, that only about five per cent of those using the railroad crossings on Long Island are distinctly careless, whereas, in previous years, and in other sections of the country, such estimates have shown a much higher proportion of careless drivers.

Further evidence of this fact, and of even more concrete nature, is seen in a comparison of the crossing accident record for 1927 with the record for 1928. This shows that whereas there were 36 fatalities and 60 non-fatal accidents at grade crossings on the Long Island during 1927, there were 33 fatalities and only 25 non-fatal accidents at these crossings in 1928.

Prolonging the Life of Hoisting Rope

A METHOD of increasing the life of wire hoisting rope by covering splices or places where wires have broken, with friction tape has been employed by John Evans, chief carpenter on the Chicago, Milwaukee, St. Paul & Pacific at Ottumwa, Iowa. This method was described in a letter which he addressed to H. F. Gibson, division superintendent, and was considered to be of such practical value that the letter has been issued in the form of a circular to all maintenance officers concerned with coaling-station operation on the railroad. An abstract of the letter follows:

Ottumwa, January 11, 1929.

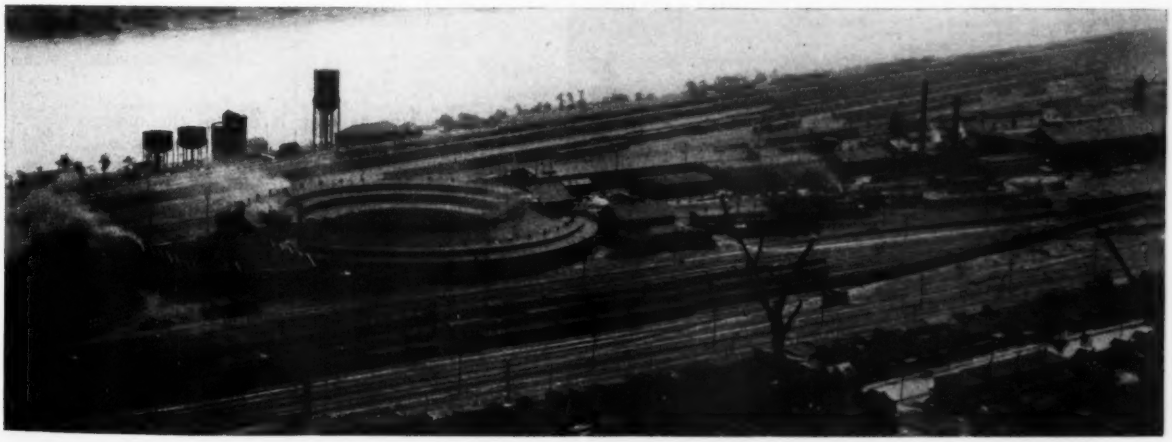
MR. H. F. GIBSON:

As you know, we use a drive rope about 350 ft. long in our coaling plants. When installing new ropes and when repairing a break in an old one we have to make splices. After running for a time the splices become rough, the ends of the wires stick out and catch, and in a short time the rope breaks at a splice. Then it is necessary to insert a short piece for a splice, so that we often have five or six splices in a rope before it is worn out, which leads to a bad condition when the rope becomes rough at these splices.

About six months ago we tried the experiment of wrapping a splice with friction tape, and when I looked at it yesterday I found the splice and tape as smooth as any other part of the rope. Consequently, I have instructed my men, when they splice a rope or find any part of it getting rough, to tape it. This tape only costs about 14 cents a spool, and the five or six spools required to fix a rope, can be put on in a very short time.

I think that all splices should always be wrapped in this manner as there is no question but that it will almost double the life of the rope. I think also that this would be a good practice to follow at all of our coal chutes, as I have given this a thorough test on the Laredo coal chute and it has proved very satisfactory.

JOHN EVANS,
Chief Carpenter.



Roundhouse and Shops at Portsmouth Yard on the Norfolk & Western

What Is E

Insure the Beauty and Permanance of Buildings Like This By Careful Maintenance

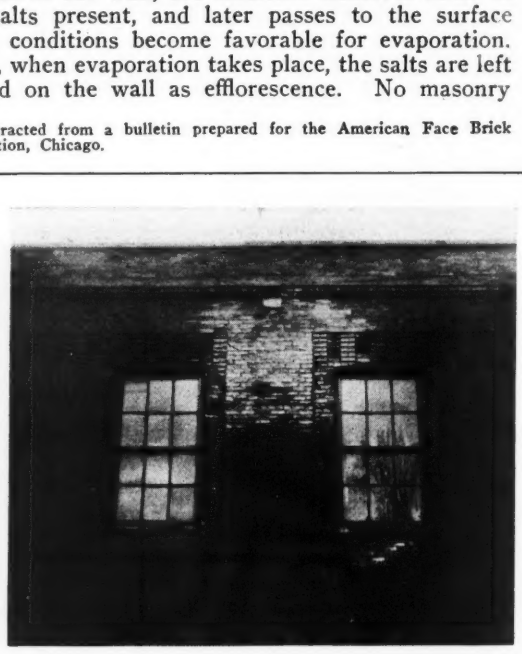
EFFLORESCENCE may occur upon the surface of any masonry wall as a whitish deposit. Whenever such efflorescence appears, it means that the wall contained both soluble salts—usually calcium and magnesium sulfates—and moisture. These soluble salts may have been in any or all of the masonry materials used in the wall, in facing, backup or mortar. The moisture may have entered the wall during construction, through exposure to rain or snow. It may have penetrated from the earth at the base or from improperly flashed parapet walls at the roof. It may have come from leaky gutters and downspouts, or from the lack of drips on cornices and sills. It may have entered through poorly filled or cracked mortar joints in the wall.

Once in the wall, the moisture dissolves some of the salts present, and later passes to the surface when conditions become favorable for evaporation. Then, when evaporation takes place, the salts are left behind on the wall as efflorescence. No masonry material is always exempt from contributing to the development of noticeable efflorescence, but some materials contain much larger quantities of soluble salts than others, and consequently are much more important sources of trouble.

The prevention of efflorescence must begin with the design of the building, follow through the selection of materials and the methods of work during the construction period, and continue with the maintenance of the structure after its completion. However, the methods recommended and the precautions necessary are merely those of good practice and do not involve radical departures from recognized standards except possibly in the adding of a water-repellent to the mortar. But the neglect of certain simple precautions may bring very unsatisfactory results.

Aside from being the direct cause of efflorescence, an excessive amount of moisture in the materials of a wall accelerates disintegration of such materials through alternate freezing and thawing of this moisture in the wall. Damp interiors are often another

*Abstracted from a bulletin prepared for the American Face Brick Association, Chicago.



Defective flashing is one of the most numerous of the immediate causes of efflorescence and wall disintegration, and is often intensified by poor design and construction of copings. Wall copings, cornices, rails, chimney caps, etc., should be built of concrete, stone, terra cotta or metal with ample overhanging drip groove or lips and watertight joints. The photograph shows the effect of the defective flashing of a parapet wall and an inadequate drip.

Efflorescence?

*How It Can Be Prevented and Cured**

By L. A. PALMER

Research Associate, United States Bureau of Standards

The two photographs show an example of disintegration induced by settlement cracks and later accelerated by excessive penetration of water, due to a leaking downspout. In this instance, the mortar joints have disintegrated.

undesirable condition attending the disintegration and occurrence of efflorescence. It is, therefore, seen that a study of efflorescence from the standpoint of proper design, construction and maintenance must, of necessity, involve also certain phases of the study of the disintegration of materials in walls and of damp interiors. This is the most important reason for making a concentrated effort in all future construction to make and preserve dry walls.

In an investigation of the causes of and remedies for efflorescence on face brick walls, conducted by the American Face Brick Association at the laboratory of the United States Bureau of Standards, it developed that the soluble salts that would otherwise be present in clay products used in construction can be practically eliminated by the manufacturer of such materials by certain procedures in the drying and burning of his ware, together with the judicious use of barium compounds in his clay. These procedures are at present being generally used by the face brick industry and in part justify the difference in cost between face brick and the cheaper clay products, hollow tile and common brick used generally as backing up materials. From an economic standpoint, it is not always practicable for the manufacturers of common brick and hollow tile to adopt the procedures used by the face brick industry in eliminating soluble salts. From the standpoint of efflorescence, it is, therefore, essential that these backing up materials be protected from excessive water penetration. These efforts on the part of face brick manufacturers to reduce the amount of salts in their own product will not alone suffice in eliminating efflorescence.

Occurrence of Soluble Salts

In the investigations at the Bureau of Standards, 55 types of face brick from as many different manufacturers in various parts of the United States were examined for soluble salts. Six types of common brick and four each of widely used limes, portland cements and bricklayers' cements were also studied. The majority of the face brick contained less than 0.05 per cent of soluble sulfuric anhydride (taken as the chemist's guide to the soluble salts present). This amount is ordinarily insufficient to cause efflorescence, even under conditions favorable for its development.

Each sample of common brick exceeded this amount and the average of all six types was 0.16 per

Moisture resulting in efflorescence and eventually in disintegration sometimes enters the wall simply as rain driven against it by the wind. Overhanging eaves offer an excellent measure of protection to walls from this source of trouble, although this protection is generally limited to the upper parts of the wall. The stucco-covered wall in the illustration is an example of disintegration resulting from excessive water penetration.

cent. The lowest figure for the limes was 0.5 per cent. The portland cements and bricklayers' cements also contained varying quantities of these salts, and in the tests each was found to develop efflorescence when used in certain panels with face brick which alone—that is, tested without mortar—did not develop efflorescence. Other investigations of limes and building limestones have established the presence in these materials of the same soluble salts found in brick.

Making Mortar Water-Repellent

Since water ordinarily penetrates into a wall through the mortar joints rather than through the brick or stone, careful study was given to methods of making the mortar water-repellent. The plan recommended is the addition of two per cent by weight of calcium or ammonium stearate to the cement, lime or mixture of the two used in the mortar. Mortars so treated were found to be very effective in preventing the passage of moisture in all cases wherein only ordinary capillary forces obtain. While best practice would call for the use of stearate in mortar for backing as well as facing materials, it is especially important that it be employed in laying up the facing where the joints will be subjected to unusual exposure to driving rains or to water running down the surface of the wall. Joints of copings, window sills and parapet walls are all in need of especial care. In repointing joints that have cracked, water-repellent mortar is called for, as such joints are usually in highly exposed locations.

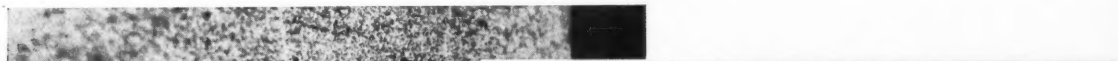
Calcium stearate is a powder which is mixed dry with the cement before adding sand and water, while ammonium stearate is a paste which is usually added to the mixing water. On the ordinary building job, the powder has proved the more practical and accurate to use with the equipment commonly available. These stearates can be obtained from chemical manufacturers, or integral water-proofing compounds containing them can be had through dealers in building supplies and companies making such products. Every care should be taken to insure getting reliable material, and unless the particular product being considered is known to be satisfactory, it should be given suitable laboratory tests.

Other Precautions for Keeping Walls Dry

Specific recommendations that will help in preventing water from entering the wall are as follows: Use impervious copings, and point joints carefully with water-repellent mortar. Flash parapet walls, carrying the flashing completely through the wall one or two courses above the roof level, and waterproof the entire inner side of the wall. Likewise flash the washes of pediments and dormers.

Always provide adequate drips on all copings, cornices and window sills, making the grooves at least 5/8 in. wide and 3/8 in. deep, and provide projections of 2 in. or more so as to keep the drip away from the wall.

Use lug sills at windows, with slopes from the sides of the window to the opening and at right angles to the wall, and, where practical, avoid all joints in the sills. If brick sills are desired, flash under them with suitable metal flashing provided with drips. Employ projecting rows of brick very cautiously, and use water-repellent mortar for the joints beneath them.



The wall shown in the photograph has been pointed twice and is already in need of a third pointing. The detail view shows how the mortar has disintegrated.

Avoid vertical joints in any sort of masonry wherever possible, and be sure water-repellent mortar is employed in such joints.

Protect walls under construction to prevent rain or melting snow from entering. Pile brick, tile, stone and similar materials on boards as delivered to the job to avoid contact with moist ground, and keep them covered. Keep gutters and downspouts in good repair, and make sure that they are adequate to carry the water. Point up cracked joints promptly. Coat the backs of retaining walls with an impervious layer, and keep brick building walls away from contact with the earth.

Classification of Various Types of Efflorescence

While efflorescence is most common in early spring, when walls saturated by melting snow or late winter rains are drying out, it may occur at any time of the year. It may appear quite generally over a wall, or be confined to certain small areas. Analysis shows there are these four conceivable conditions under which efflorescence may occur:

Condition A. Excessive water with only a normal amount of salts in the wall.

Condition B. Excessive water and an excessive amount of salts in the wall.

Condition C. Normal water and normal salts.

Condition D. Normal water but excessive salts.

Obviously the first two conditions, A and B, are the worst because disintegration may go hand in hand with efflorescence, owing to the disruptive action of freezing and thawing. Condition B is of course worse than A.

Efflorescence occurring under Condition C is usually very mild. Condition D may cause some

trouble, but like C, is usually only temporary and tends to disappear entirely as time goes on.

General efflorescence is apt to mean either condition B or D, where the wall contains excessive salts. Special efflorescence usually indicates Condition A, characterized by excessive water which is being allowed to penetrate the wall by some fault in design, construction or maintenance. Every instance of a leaking downspout, dripless sill or unflashed parapet wall may cause excessive water penetration.

Field Study Shows Efflorescence Preventable

As part of the field investigation of efflorescence, William C. Kosh, of the Research committee of the American Face Brick Association made an extensive study for the purpose of correlating the fundamental facts about the development of efflorescence with design, construction and maintenance of buildings. Finally, a detailed study was made of 250 cases of efflorescence and the usual accompaniment, wall disintegration. The Bureau of Standards report comments as follows:

"With but one or two definite exceptions, the 250 cases of discoloration and disintegration could have been prevented by either proper design, construction or maintenance. In some cases only one of these three factors was the direct cause, but usually there were two and in a number of cases all three were at fault.

"Efflorescence was observed on almost every type of building material . . ."

"Where prompt pointing up was not done and where the condition had lasted over a period of years, disintegration of the mortar joints almost invariably had occurred. In any case where underburned brick had been used, these also had become disintegrated."

The action of sulfur dioxide in accelerating the disintegration of certain masonry materials is well known, and must be considered in cities burning bituminous coal. Snow water may be sufficiently acid to attack the lime of mortar or certain limestones, but tests made at the Bureau of Standards have shown face brick highly resistant to solutions of sulfur dioxide in water and even to fairly concentrated acid solutions, such as 10 per cent hydrochloric, sulfuric and nitric acid. However, the need of prompt pointing up of mortar joints is apparent.

Recapitulation of Results of Investigation

The purpose of the foregoing is to point out the fact that in the main, the immediate cause of efflorescence and often of wall disintegration, as well, is excessive penetration of moisture into the wall. The field work supplemented the fundamental work that had already been done and that had established the fact that hardly any masonry material is exempt from the possibility of containing soluble salts in quantity such that it may, under favorable conditions, contribute to the development of noticeable efflorescence. The favorable conditions are wet walls.

With but one or two definite exceptions, all of the large number of instances of efflorescence and in some cases of wall disintegration that were studied could have been prevented if due consideration and care had been given to the proper design, construction and maintenance of these buildings.

Efflorescence can become very noticeable on the wall of a building composed of brick or other masonry materials that are exceptionally low in soluble salt content if excessive water enters that wall.

Any efflorescence appearing on the wall of a building that is suitably designed, constructed and kept in repair in order to avoid excessive water penetration, will be due to rare and abnormal conditions. It will in time gradually diminish and finally disappear. It will never recur under normal conditions, even though the soluble salt content of the entire wall be higher than is normally the case. Prolonged and heavy wind-driven rains will bring out efflorescence on almost any wall, but this efflorescense is of the temporary nature described.

A Versatile Tractor

THE utilization of a "Caterpillar Thirty" for throwing track and for transporting ties and other track material has effected economies in these operations and has enabled the machine to be kept busy when not engaged in stripping sod from the marl deposits of the Sandusky Cement Company, Baybridge, Ohio.

For throwing the tracks serving the pit, a chain from the rear end of the tractor is attached to the track and the machine is started ahead slowly until the desired limit of throw at any one point is reached, when the chain is detached from the track and the tractor moved to a new location, where the operation is repeated. When hauling ties or other materials, they are piled on the bucket and the arms supporting the bucket, thus dispensing with the use of a trailer. It is said that it is possible to carry as many as 25 ties in this manner and to transport them economically for a distance up to a mile from the base of supplies to the end of the track, the ability of the machine to travel over soft, uneven ground contributing to its efficiency in situations such as are encountered at the marl pit.

The Tractor Engaged in Stripping Operations

The sod and dirt overlying the marl is from 4 to 14 in. deep, and the tractor is equipped with a Killifer bucket for removing this deposit. The shovel used for excavating the marl is a 3½-yd. Bucyrus, which cuts a width of 35 ft. and a length of 80 ft. daily, and it is said that the tractor is able to strip three day's work ahead of the shovel in one day.

The Caterpillar Throwing Track

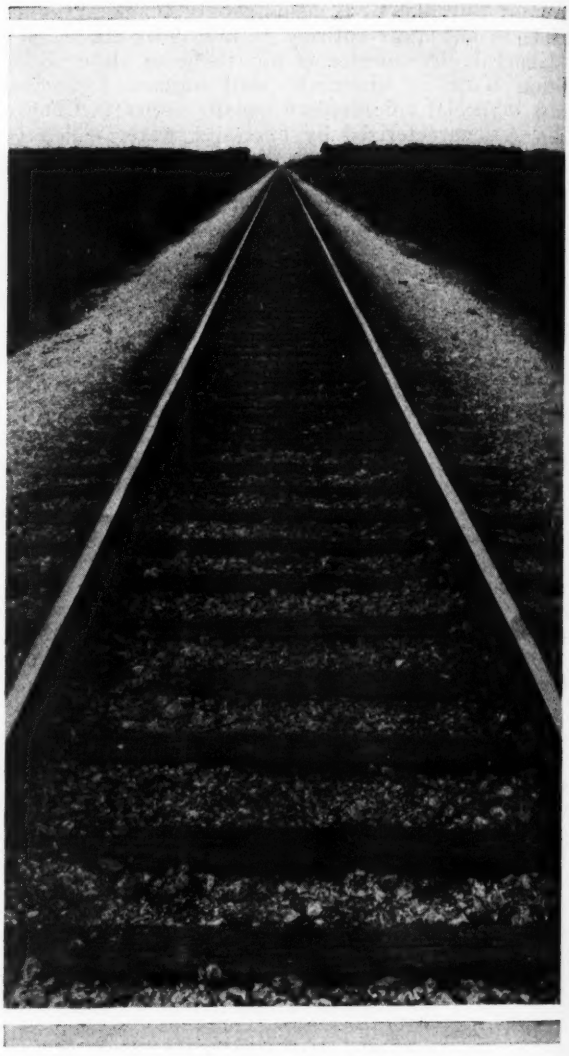
Making Timber Last Longer

Convention of Wood-Preservers Association devoted largely to study of problems of protecting materials for railway use

THAT the railways will long continue to lead other wood-using industries in the conservation of forest resources through the treatment of the timber with preservatives to protect it against decay, was evidenced through the convention of the American Wood-Preservers' Association at Louisville, Ky., on January 22-24. It was shown in a paper presented by A. F. Blaess, chief engineer of the Illinois Central, describing that road's experience with treated timber and also in a paper presented by Grant B. Shipley*, president of the Century Wood Preserving Company, Pittsburgh, Pa., on the Trend of Wood Preservation; it was evident in a talk made by Dr. Herman von Schrenk, consulting timber engineer for a number of railways, on the Use of Treated Wood in Bridge Construction, as well as in reports of committees on Tie Service Records, on the Treatment of Car Lumber, on Fence Posts, etc. All sessions were presided over by H. R. Condon, consulting engineer, Century Wood Preserving Company, who at the time of his election was forester of the Pennsylvania.

The meeting was the most largely attended in the history of the association, 242 members registering, who, with the members of their families and other guests, comprised a party of more than 400 persons. The report of the secretary-treasurer showed a membership of 748 on December 31, 1928, a net gain of 16 during the year.

Dr. von Schrenk spoke extemporaneously on the results of a study that he has just completed on the service secured from creosoted timber in ballast deck bridges. In addition to the examination of many such structures on several roads, he sent a questionnaire to eight railways with 20 years or more experience with ballast-deck treated-timber structures to determine the economies which this form of construction has shown in service. This survey has shown that such failures as have occurred have been due to (1) structural failures in the timber, such as shearing in stringers and (2) to decay in the tops of piles, around drift bolts, etc. These failures demonstrate the necessity for high-grade timber, for there is no advantage in treating timber that will not withstand the loads. They also show the necessity of preventing the mutilation of timber through chamfering of the tops of piles, the application of sway bracing, etc. Dr. von Schrenk emphasized the difficulty of protecting pile cutoffs and stated that the best results had been secured by applying hot creosote to the top of the pile and then attaching a sheet of felt to the top with a sealing material and placing the cap on that. "The best way to avoid decay about holes," he said, "is to eliminate the holes."



A 20-Year Record

Of 24,238 creosoted, hewn pine ties inserted on the Emporia cut-off of the Santa Fe near Melvern, Kan., in 1906, there were 20,468 ties still in track on December 31, 1926.

In addition to the papers and reports that will be referred to on later pages, reports and papers of interest to railway men included one on termites by Thomas E. Snyder, senior entomologist, Bureau of Entomology, U. S. Department of Agriculture, describing the habits and methods of protection against this enemy of wood, whose effects are becoming pronounced in a number of quarters, particularly in Southern California; and a paper urging that the absorption of wood preservatives should be be based on the dimensions of the timber by J. D. MacLean, senior engineer, United States Forest Products Laboratory, Madison, Wis. Numerous refinements in practices to incorporate the results of recent studies were presented by the Committees on Preservatives, on the Treatment of Lumber, on the Non-Pressure Treatment of Poles, etc.

At the concluding session of the convention H. E. Horrocks, manager, Pacific Creosoting Company, Seattle, Wash., was elected president; C. C. Cook,

*An abstract of Mr. Shipley's paper appears on a following page, while Mr. Blaess' paper will appear in a later issue.

Year	A.T. & S.F. Miles	Ties	5 Yr Avg	B. & O. Miles	Ties	5 Yr Avg	C. B. & Q. Miles	Ties	5 Yr Avg	C. & E. I. Miles	Ties	5 Yr Avg	C. C. C. & St. L. Miles	Ties	5 Yr Avg	C. M. & St. P. (Eastern Lines) Miles	Ties	5 Yr Avg	C. R. I. & P. Miles	Ties	5 Yr Avg	D. L. & W. Miles	Ties	5 Yr Avg	Gt. Northern Miles	Ties	5 Yr Avg	Ills. Central Miles	Ties	5 Yr Avg
1900	8.604	198								1.061	248																		
01	9.360	188		8.778	248					1.077	230					8.303	190							6.342	229				
02	9.557	204	220	8.263	196					1.146	226					8.617	213							6.487	228				
03	9.768	241	210	8.460	192					1.188	198					8.848	144							6.972	164				
04	10.237	271	215	8.667	225					1.251	133	227				9.183	121							7.066	169				
05	10.665	256	226	8.904	247	222				1.391	109	192	3.525	369		9.263	97	157						7.189	183	202			
06	11.637	197	234	9.052	245	221				1.479	148	163	3.577	392		9.447	116	136						7.416	162	190			
07	11.694	286	251	9.168	254	233				1.493	217	161	3.788	301		9.102	94	114						7.644	125	169			
08	12.169	301	263	9.231	266	247				1.507	199	151	3.777	275		9.946	176	121	9.006	289				8.376	240	192			
09	12.601	293	267	9.260	264	255				1.514	121	159	3.801	198	307	10.001	202	137	9.311	276				8.637	249	209			
1910	13.379	281	272	9.370	218	249				1.522	200	177	3.834	384	310	10.043	203	196	9.311	246				8.819	293	231			
11	13.689	295	286	9.548	206	242				1.520	134	174	3.925	388	309	10.153	139	187	9.311	265				8.990	182	259	6.978	290	
12	14.488	220	273	9.908	218	240				1.572	169	169	3.960	318	313	10.135	163	167	9.605	209	256				9.150	228	256	9.438	867	
13	14.766	193	251	9.906	259	245				2.006	289	187	3.973	382	344	10.590	208	187	9.311	221	243				9.395	237	254	9.320	286	
14	15.293	178	228	9.853	220	236	12.664	231		2.046	202	203	4.010	269	326	10.697	190	185	10.118	243	237				9.689	238	250	9.371	266	
15	15.409	207	213	9.924	309	254	12.854	227		2.053	255	214	4.001	277	307	11.021	163	181	10.044	249	237				9.863	279	254	10.104	229	236
16	16.151	201	200	9.973	310	275	12.993	203		1.892	244	230	4.021	212	272	11.072	251	159	10.044	222	229				8.856	195	248	10.014	250	235
17	16.276	158	187	10.043	236	267	13.288	192		1.871	187	235	4.030	202	246	11.100	133	193	10.063	183	224				8.663	157	233	10.513	244	236
18	16.554	154	160	10.100	194	254	13.331	194	209	1.880	166	211	4.110	203	233	11.107	226	197	10.274	155	210				8.671	121	201	10.676	250	241
19	16.711	143	173	10.133	243	259	13.365	162	196	1.867	141	199	4.173	201	219	11.112	242	208	10.274	150	193				8.675	147	180	10.620	253	245
1920	16.984	163	164	10.109	255	246	13.365	178	186	1.865	102	168	4.177	196	195	11.087	146	200	10.290	190	182				8.677	159	156	10.632	213	242
21	16.933	149	153	10.126	229	232	13.365	171	181	1.863	63	132	4.210	194	192	11.100	161	182	10.319	169	171				8.675	168	150	10.662	184	229
22	17.104	156	153	10.171	206	225	13.420	167	176	1.854	131	121	4.209	143	180	11.068	188	193	10.323	151	185				8.678	137	146	10.669	191	216
23	17.346	178	148	10.163	207	215	13.530	168	171	1.862	192	119	3.932	191	177	11.182	225	192	10.428	140	162				8.679	102	142	10.697	220	212
24	17.709	115	143	10.165	192	210	13.530	150	166	1.861	98	109	3.946	139	165	11.098	204	165	10.371	118	134				8.676	83	133	10.783	201	202
1925	18.050	107	137	10.169	200	207	13.586	152	163	1.863	86	106	4.018	140	161	11.140	137	155	10.384	139	143				8.703	98	118	10.772	195	196
26	18.474	117	125	10.068	196	200	13.603	151	158	1.862	112	116	4.035	106	144	11.229	205	204	10.428	141	138				8.727	92	103	10.601	201	202
27	18.946	132	120	10.665	114	194	13.599	152	155	1.871	121	114	4.042	101	135	11.861	272	221	10.417	153	138				8.726	98	95	10.960	212	206
A				1917						1907			1906			1916			1910						1913			1922		
B	3.036			2.601			2.971			2.930			2.808			2.830			2.826						2.613			2.907			2.325		
C	1925		96			34			100			99			95			60			99			91			90			84
	26		96			36			100			99			99			62			100			94			75			98
	27		99			37			100			100			100			94			99			96			75			99
D	1924					60			97			90			83			60			80			82			20			
	25		66			67						92			85			83			82			85			25			74
	26		66			72						99			89			65			85			87			30			75
	27		92			77			96			99			92			65			87			90			37			78

Year	K.C. Sou. Miles	Ties	5 Yr Avg	Lehigh Valley Miles	Ties	5 Yr Avg	Mich. Cent. Miles	Ties	5 Yr Avg	M.K. & T. Miles	Ties	5 Yr Avg	Monon C. I. & L. Miles	Ties	5 Yr Avg	N.Y.C. (East) Miles	Ties	5 Yr Avg	N.Y.C. (West) Miles	Ties	5 Yr Avg	Nor. Pacific Miles	Ties	5 Yr Avg	Penna. Miles	Ties	5 Yr Avg	Soo Line Miles	Ties	5 Yr Avg
1900				2.807	336		2.853	269														6.273	341		14.799	294				
01				2.856	301		2.976	241		2.410	404					8.112	228					8.329	324		15.143	291				
02				2.863	306		3.053	262		2.401	401					8.260	210					6.493	311		15.901	273				
03				2.893	307		3.136	237		2.380	437					6.292	207					6.636	314		16.751	264				
04				2.911	211	253	3.102	141	234	2.741	460					6.436	243					6.916	200	349	17.330	217	264			
05				2.930	196	225	3.334	146	210	2.560	387	416				8.870	173	213	3.565	246		7.030	286	305	17.866	279	261			
06				3.060	155	195	3.452	173	196	3.041	344	406				6.716	176	202	3.666	257		7.253	280	294	18.527	241	251			
07				3.090	104	211	3.527	110	162	3.065	358	397				6.915	263	213	3.683	261		7.312	348	301	18.645	267	250			
08				3.158	172	184	3.598	110	136	3.232	393	366				7.211	215	216	4.195	266		7.938	251	269	18.963	196	240			
09				3.171	195	180	3.602	212	163	3.316	365	349	808	310		7.258	220	212	4.307	250	256	6.258	296	332	19.016	262	249			
1910	1.196	462		3.191	177	177	3.609	176	166	3.401	449	362	816	257		7.445	249	227	4.668	230	257	6.430	282	293	19.508	240	242			
11	1.846	432		3.199	141	174	3.615	285	191	3.647	466	386	829	396		7.335	229	237	4.770	280	257	6.761	284	294	20.083	238	240			
12	1.251	294		3.245	164	170	3.626	208	210	3.722	401	395	843	365		7.362	219	228	4.949	265	258	6.859	287	292	20.213	250	245			
13	1.261	351		3.277	267	189	3.659	305	249	3.907	342	405	851	360	342	7.766	259	235	5.015	290	264	9.288	317	295	20.441	261	256	4.973	236	
14	1.273	355	379	3.313	232	196	3.758	284	252	3.958	324	396	856	365	353	7.800	271	245	5.036	242	262	9.422	306	297	20.578	292	264	3.113	187	
15	1.289	354	357	3.320	289	219	3.766	335	283	4.021	325	372	858	231	347	8.000	243	244	5.010	301	273	9.636	276	294	20.686	314	276	3.279	236	
16	1.289	336	338	3.364	286	248	3.884	357	298	4.065	382	353	857	289	326	8.054	207	240	5.013	273	279	9.678	247	287	20.829	287	292	3.289	196	
17	1.290	240	328	3.408	178	250	3.922	227	302	4.082	235	322	897	145	278	8.099	197	235	5.069	210	276	9.789	292	288	22.524	212	272	3.306	228	243
18	1.290	237	305	3.396	173	236	3.928	197	280	4.140	209	295	903	168	240	8.148	199	223	5.131	249	267	9.783	230	270	23.003	174	256	3.334	207	235
19	1.290	273	288	3.393	195	224	3.974	144	252	4.196	226	276	903	80	163	8.265	199	209	5.174	189	256	9.763	220	255	23.500	811	240	3.339	246	231
1920	1.302	290	276	3.399	116	190	3.967	128	210	4.227	302	271	906	161	170	8.230	184	193	5.183	183	253	9.869	242	246	23.083	808	217	3.325	269	231
21	1.308	310	270	3.401	133	139	3.952	134	170	4.245	233	241	907	146	141	8.577	220	196	5.168	196	217	9.899	231	243	23.112	232	208	3.504	342	268
22	1.303	249	272	3.413	77	139	3.868	222	169	4.251	243	231	910	146	141	8.471	198	196	5.194	186	203	9.920	167	218	23.103	232	210	3.544	301	281
23	1.324	227	270	3.414	91	122	3.946	208	170	4.275	179	225	911	144	137	8.599	201	197	5.240	147	182	9.798	177	207	23.691	211	208	3.520	325	324
24	1.325	225	260	3.421	109	105	3.946	214	164	4.367	213	222	918	153	151	8.231	173	192	5.361	129	170	9.765	163	196	23.346	177	180	3.680	336	318
25	1.378	152	233	3.424	91	100	3.902	173	194	4.374	237	209	926	135	145	8.190	177	194	5.388	110	156	9.748	176	183	23.400	207	212	3.552	372	329
26	1.380	122	195	3.428	82	90	3.870	155	194	4.379	231	209	932	125	141	8.133	170	184	5.312	93	135	9.729	147	166	23.408	204	206	3.552	394	375
27	1.372	130	171	3.432	92	93	3.870	136	177	4.319	241	220	944	113	134	8.143	160	176	5.381	89	114	9.716	136	160	23.569	165	193	3.756	286	306
A	1914			1914			1915			1904			1910						1915			1913			1920					
B	2.938			2.786			2.875			2.970			3.040			2.976			2.935			3.000			2.700			2.882		
C	1929		75			95			89			100						87			91			56			90			82
	26		93			100			94			100			96			94			94			69			97			89
	27		93			100			93			100			96			97			92			96			91			88
D	1924		55			70						63			52			52			65			52			44			9
	25		62			72			60			73			56			56			92			54			30			10
	26		65			73						76			58			61			94			58			36			14
	27		68			78						82						66			94			63			61			18

Year	Southern Pac. (Atlantic Syst.) Miles	Ties	5 Yr Avg	Southern Pac. (Pacific Syst.) Miles	Ties	5 Yr Avg	Union Pacific Miles	Ties	5 Yr Avg	C. R. R. of N.J. Miles	Ties	5 Yr Avg	Reading Miles	Ties	5 Yr Avg	Missouri Pacific Miles	Ties	5 Yr Avg	TOTALS FOR ALL ROADS Miles	No. of Roads	Ties per Mile	5 Yr. Avg
1900	3.501	261		6.473	236		3.088	261		1.316	218								39.309	12	264	
01	3.681	278		7.289	249		3.098	242		1.331	273								67.114	16	294	
02	3.753	293		7.392	252		4.007	299		1.340	266								90.418	16	238	
03	3.847	269		7.552	196		3.981	186		1.354	246								92.585	16	229	
04	4.052	197	264	7.674	187	223	4.044	303	244	1.373	275	250							95.653	16	223	242
05	4.100	233	254	7.934	174	211	4.064	266	245	1.340	321	278							105.477	16	229	235
06	4.166	339	266	8.012	275	217	4.182	374	272	1.372	206	264							108.654	16	229	230
07	4.343	258	259	8.120	197	206	4.386	317	289	1.403	208	251							111.154	16	247	232
08	4.377	248	258	8.418	324	233	4.393	238	304	1.430	247	251							123.529	19	245	235
09	4.401	259	267	8.677	218	236	4.924	253	294	1.434	259	246							126.852	20	254	241
1910	4.413	269	278	8.907	240	251	5.003	267	294	1.464	248	231							130.911	21	239	243
11	4.504	261	263	9.067	247	245	5.291	296	266	1.491	207	232	2.958	200		9.184	387		155.120	24	262	249
12	4.519	290	272	9.401	225	250	5.465	171	239	1.531	220	234	3.005	297		9.329	409		158.818	24	257	251
13	4.556	271	277	9.234	193	225	5.617	231	234	1.569	240	233	3.032	325		9.451	389		166.664	24	262	253
14	4.613	295	284	9.488	205	222	5.616	248	233	1.612	224	226	3.042	267		9.444	394		181.770	26	256	255
15	4.694	384	303	9.556	232	221	5.685	236	227	1.633	189	215	3.360	290	294	9.446	383	392	183.966	26	268	261
16	4.767	367	325	10.103	243	221	5.722	253	228	1.665	150	206	3.360	192	274	9.486	318	378	186.072	26	253	259
17	4.806	196	303	10.368	180	218	5.815	196	233	1.661	127	187	3.426	176	250	9.329	325	362	189.641	26	207	249
18	4.879	218	292	10.434	244	223	5.994	191	225	1.713	127	165	3.463	166	219	9.353	260	336	191.695	26	198	236
19	4.885	261	280	10.366	253	232	6.024	185	213	1.745	132	146	3.474	153	196	9.343	314	320	192.660	26	208	227
1920	4.929	388	287	10.492	261	236	6.033	206	208	1.749	114	131	3.476	126	163	9.340	315	306	194.613	26	209	215
21	4.992	399	292	10.506	248	239	6.054	184	196	1.734	161	136	3.483	169	150	9.393	267	300	195.332	26	212	207
22	4.999	319	317	10.363	214	244	6.167	203	194	1.743	142	139	3.484	180	159	9.474	300	293	195.946	26	207	206
23	4.988	294	332	10.777	216	238	6.227	199	196	1.748	116	137	3.467	180	162	9.491	265	296	197.336	26	180	203
24	5.013	265	332	12.869	204	229	6.262	215	201	1.749	133	137	3.493	169	169	9.502	321	239	200.226	26	162	196
25	6.016	836	301	12.954	244	225	6.295	214	202	1.757	115	137	3.500	167	181	9.600	325	301	201.793	28	187	194
26	6.077	217	267	13.400	246	225	6.371	208	207	1.755	85	116	3.500	194	186	9.714	280	299	203.352	26	181	187
27	6.301	237	250	13.437	209	224	6.397	163	203	1.770	66	103	3.525	152	180	9.617	236	291	204.248	26	175	182
A	1910						1906									1916						
B	2.978						2.803			2.413						2.882						
C	1925		56						95						61							
	26		66			81			100			100			93			62				
	27		77			82			100			100			96			67				
D	1924		44			57			64						55							
	25		49									82			59							
	26		41			64			78			75			75							
	27		46			62			80			84			79							

Legend

A—Year in which percentage of treated ties in track reached twenty.

B—Average number of ties per mile of all tracks.

C—Percentage treated of all ties used.

D—Percentage treated ties in track.

Five year average column is 5 years ending with year shown.

Note: Beginning 1927, miles of crossties maintained, as reported to I. C. C. excludes miles of bridge and switch ties.

Crosstie Renewals per Mile of All Tracks Maintained by 24 Railways

maintenance engineer, Baltimore & Ohio, Baltimore, Md., first vice-president; J. S. Penney, vice-president, T. J. Moss Tie Company, St. Louis, Mo., second vice-president; H. L. Dawson, secretary-treasurer, Chicago (re-elected).

S. R. Church, consulting engineer, New York City, and W. J. Smith, tie and timber agent, Missouri-Kansas-Texas, Denison, Tex., were elected members of the executive committee for a term of three years. Seattle was selected as the location of the next convention.

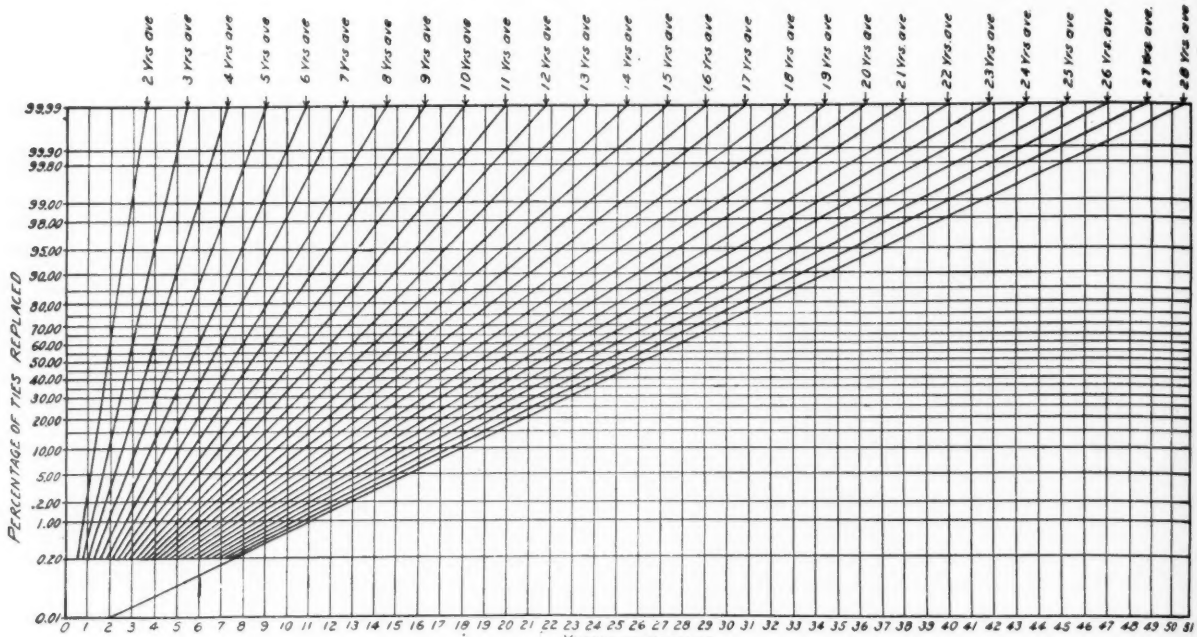


Chart Showing Average Life to Be Expected After Various Percentages of Renewals Have Been Made

The Need of Research

After calling the convention to order, President Condon reviewed the work of the association during the past year and also during the 25 years of its existence. He then urged that the organization pause at the completion of its first quarter century of accomplishment to consider the course of its work in the future.

"All industry," he said, "is undergoing remarkable and rapid changes, and this association must be alive to anticipate the future demands of the consumers and producers of preserved wood. The mistake must not be made of believing that such work terminates with the adoption and use of specific standards. The development of new preservatives and improved methods of using old ones, advancement in the art of plant operation and methods of impregnation, and the constant discovery of new fields of application of preservative treatment, require constant vigilance and effort, not only to keep abreast of such development, but to sponsor and lead them.

"This association can maintain its position as a leader in the continued development of the science and art of wood preservation," he continued, "only by vigorously sponsoring research and the development of new ideas and methods, whether concerned with preservatives, methods of impregnation, or utilization of preserved wood. The requirements for data and information needed by the wood-preserving industry and by the users and potential users of treated forest products have in some instances been a source of embarrassment to committees whose activities naturally are limited by the time and expense that members can contribute to association work. When the limitations of committee work preclude the possibility of providing needed information directly, ways and means should be found to provide for the direction and sponsorship by the association, of research and development by suitable and dependable agencies, adequately financed and controlled, results from which can be accepted by all concerned with the knowledge of the control exercised in the development of the project."

Report on Tie Service Records

The committee on Tie Service Records, of which W. R. Goodwin, engineer of wood preservation, M., St. P. & S. Ste. M., was chairman, presented a table of tie renewals per mile on 26 railroads with a total mileage of 204,246. The roads were requested to furnish this information to correspond with the data furnished the Interstate Commerce Commission relative to the crossties renewed per mile of crossties maintained. It is of interest to note that in 1927, 21 of these roads reported that 90 per cent or more of all their renewals were made with treated ties, that on 19 roads renewals per mile were less than 200 ties and that the seven roads which showed over 90 per cent treated ties in track in 1927 averaged 116 crossties renewals per mile.

WORKING ON CONSOLIDATION PLAN.—While efforts are still being made, with scant prospects of success in the near future, to induce Congress to act on a railroad consolidation bill which would remove the present direction to the Interstate Commerce Commission to prepare a complete consolidation plan, Commissioner Porter of the commission is going forward with efforts to prepare such a plan in accordance with the provisions of the present law, for submission to the commission.

Better Maintenance at Lower Cost*

Sane planning and organization, faithfully adhered to, advocated as measures of economy and efficiency

By C. A. MORSE

Former Chief Engineer, Chicago, Rock Island & Pacific, Chicago

I FEEL that I have been fortunate in having had the advantage, during the last 38 years, of having been connected with the maintenance of way of two large western railways. I have been with both roads when they were as poor as "church mice," have remained with each of them while they passed through receivership and continued with each road until it was prosperous. I was with one road 23 years, 17 of which were after the receivership; I was with the other road 15 years, 12 years of which were after the receivership. My relations with the officers and employees of both companies have been very pleasant. However, during these years of continuous service, I have noted practices that were not most economical or efficient and, now that I have retired from active service, I feel that I owe a duty to the railways to give them the benefit of my opinions and conclusions on different subjects that have interested me, and should interest all officers and employees.

Maintenance of way has been used for years as the "balance wheel" of the operating department. In former days, it was the branch of the service where a reduction in operating expenses was made when business was light; when used for this purpose, it was usually for only a temporary period, so that the shortage in maintenance expenditures was soon made up and no serious trouble ensued. With the decreases in freight rates that were made between 1908 and 1915, with the resulting decline in net earnings, there was an extended period of neglected maintenance of way on many railways which it has taken many years of better freight rates and increased business to make up, while the effects on many roads have not yet been entirely overcome. The result is that while trying to overcome this deferred maintenance, there has been little chance to study the question of handling maintenance of way work economically.

It is time that this be done, however, and it is important that a way should be worked out to permit maintenance of way to be so handled that it will not be affected by the monthly fluctuations in freight business, or by the monthly net earnings of the road. The fact that a mandatory cut in maintenance forces can be made without disturbing the train schedules has been the cause of this department being disrupted again and again, with the resulting added cost of doing necessary work, or the prevention of work being done that was necessary if the railway was to be operated economically. What was done originally as an emergency measure has, by many railways, come to be a regular practice, resulting in maintenance work being left undone, or being half done, thus adding more to the cost of operation than the supposed temporary saving.

A Disrupted Program Is Costly

We all know that in doing any maintenance work, the cost of organizing the work is much greater than the cost of carrying it out for the same period after it is organized. I have in mind a piece of work that had to be organized three times, owing to repeated disruptions, with the result that it cost 50 per cent

*Abstracted from a paper read before the Maintenance of Way Club of Chicago on January 16.

more than estimate, whereas, if it could have been carried out with the original organization, it could and would have been completed within the original estimate. Maintenance of way work cannot be handled economically piecemeal; it must be organized for the season, or for the year. If an attempt is made to handle it on a hand-to-mouth basis, the cost is increased materially. The first step is to get the maintenance of way appropriations made for the year and all restrictions taken off, with the object of doing the work economically.

We all know that a saving could be made if we could perform all possible work on the track when there are the least number of trains to interfere with it. We know that rail can be laid and that pile or frame bridges can be worked on in the winter, except that it may be economy to drive the piling in the summer and fall. Building work can be carried on in winter as well as in summer. We used to think that concrete work could not be carried on in the winter, but one has only to look around him in Chicago and see multiple-story reinforced concrete buildings going up in January to realize that winter does not stop that class of work.

In order to perform work in the winter months, the budget must be approved early enough in the fall so that material can be ordered and delivered and so that rail can be contracted for in time for delivery to begin in January; preferably, some of it should be delivered in December. The approval must also be early enough to permit getting the track fastenings to take care of the rail as soon as it is delivered.

One of the conditions that has been interfering with economical maintenance of way for the last few years is an effort to reduce the balance carried by the store department. There is no doubt but that the storekeepers, as well as merchants all over the country, have been able to reduce their stocks owing to the better transportation furnished by the railways, but when the store department reduces its stocks below the requirements of the railroad and delays work on account of not carrying sufficient materials, it is the opposite of economy—it is extravagance.

Machines Must Be Kept Busy

Machinery has been introduced extensively during the last ten years to do much of the work that was formerly done by hand. The increase in wages has been a great incentive to invention. With the low wages of ante-bellum days, only a small saving could be made by mechanical appliances, but, with the present scale of wages, there has been an opportunity to make a fine showing by the introduction of mechanical appliances. With the extensive use of machinery, it is important to keep it in operation as nearly as possible throughout the year, as the interest on the investment is continuous and will eat up the profit if the equipment is permitted to lie idle half or two-thirds of the time.

Some roads have organized their track laying so as to have but two or three large, well-organized gangs on this work, moving them from place to place and doing all of their track laying with these well-trained and well-equipped gangs, whereby they claim to be able to make very decided savings in cost. The same thing could be done with ballast gangs where track is being raised out of face, especially following the relaying of rail. Some roads are keeping small gangs on the sections and utilizing them throughout the year, bringing in extra gangs to do the larger jobs, thus giving steady work to the men on the sections and giving as nearly as possible continuous employment to the men on the extra gangs, by moving them from division to division. Where a railway has enough variation in climatic conditions, it does this by using the men in the south in the winter and in the north in the summer. In order to handle maintenance of way work economically, it will readily be seen that there must be planning of the work by some central head and that there must be no interruptions of the plans due to fluctuations in the maintenance allowance. To avoid such interruptions, the appropriations for the year must be available when and where the carefully worked-out plans call for their use.

In the case of the Chicago, Rock Island & Pacific, with its 8,000 miles of main tracks, and 12,000 miles of all tracks to maintain, the expenditure required to maintain these tracks properly amounts to between $18,000,000 and $20,000,000 per year, and that is too large a sum of money to be spent in a haphazard way. I have no doubt but that with a yearly allowance, not restricted as to the amount to be spent in any one month, just as good results can be secured as on monthly allowances—and that a saving of five per cent, or from $900,000 to $1,000,000 per year, could be made in maintenance of way. In other words, by spending the same amount as is now done by the monthly allowance method, the road would have that much more to spend on better maintenance, particularly in greater refinements in line and surface.

Savings From Proper Use of Materials

Large savings can also be made by the proper use and handling of material. Take for instance, the track tie. The use of treated ties is now pretty general and should be universal. A careful inspection of the tie requirements should be made early in the fall and wherever ties are found needing renewal, they should be renewed without fail, since no detail of track maintenance is so essential to economy as good ties to support the rail. Where rail is to be relaid on ballasted track (and it is practically all ballasted these days), the renewal of ties should be planned to remove those which will not last three years, so that when the track is ballasted out of face, following the track laying, it will not have to be disturbed until it again requires surfacing out of face. Those ties taken out, which have from one to three years life as main-line ties, can be inserted in side tracks where they will have from three to nine years remaining life.

With the locomotives and cars of the present day, which are increasing in weight every year, no new rail should be purchased lighter than 110 lb. per yd. It will be only a few years until rail weighing less than 100 lb. per yd. will be too light even for branch lines, and rail in yards and sidings will or should weigh not less than 85 or 90 lb. per yd. The main-line life of even a 110-lb. rail will not be more than 8 to 12 years in important main lines, after which it will have to be replaced and used on secondary lines or for repairs. The rail that is not fit for use in replacing rails in important main lines must have some work done on it before it is fit for main-line use. A portion of it can be repaired by "cropping" or sawing off the ends, but there will probably be a third of the released rail that cannot be utilized for main line use by "cropping," and unless something else is done to it, it is relegated to passing tracks and yards. A rail weighing 110 lb. per yd. or heavier can be

recovered for main line use by rerolling, which process relieves all internal strains and produces a rail that is tougher than a new rail, owing to the additional passes through the rolls.

Rerolling Heavy-Section Rails

About 30 years ago, the practice of rerolling rail was in quite general use, but the rapid increase in the weight of locomotives made it necessary to adopt a heavier rail. Since the lighter rail produced by rerolling a 70-lb. or 80-lb. rail, which was the common weight of main-line rail at that time, was too light to make it pay to reroll it, the practice went largely out of use. Now, however, with new rail weighing from 110 lb. to 140 lb. per yd., there is no reason why the railways should not recover the released main-line rail that now has to go into siding and yard tracks, and get a first-class rail of better quality than new rails as well as the full benefit of the additional metal that they are having to purchase in their new heavy-section rail.

The subject of rerolling rail was discussed by a subcommittee of the American Railway Engineering Association, but, unfortunately, little interest was displayed and a report adverse to the rerolling of rail was allowed to pass into the records of the association, which has had some influence. The committee undertook to develop the economies of the subject and in doing so charged the rerolled rail with the value of the second-hand rail as relayer rail. By doing this and adding some theoretical freight charges, they produced figures that indicated that it was cheaper, or just as cheap, to buy new rail. The facts are that the rail released in relaying important main lines is only a "by-product" of the maintenance of the more important line.

Railways do not buy or sell second-hand rail that is heavy enough for use in other tracks. They utilize this released rail wherever they can and that which is not fit for main-line use is relegated to yards and siding where it replaces other rail which, while lighter, does not have to be replaced at the time and which will be replaced from time to time by curve-worn rail, taken out of the main tracks. The facts are that this rail can be rerolled into first-class main-line rail for about one-fourth of the out-of-pocket cost of new rail and will give a main-track life of from 15 to 25 years in secondary lines, where the weight of the rerolled rail will take care of the traffic. The Rock Island has some rerolled 80-lb. rail that has been for more than 22 years in a main line, over which high-class passenger trains are operated, but on which the freight traffic is light. It has rerolled rail in a number of less important lines that has been in service for more than 25 years and is not yet on the program for renewal.

Rock Island Is Rerolling 100-lb. Rail

The Atchison, Topeka & Santa Fe rerolled about four hundred miles of 70-lb. rail between 1896 and 1898 for use on its Coast Lines where some of it is still in sidings. The Rock Island has been rerolling rails again for the last four years. When it started this last rerolling, the mill was in poor condition and the results were not what they should have been, but the road kept after the mill until the details of the plant were improved. In 1928, this road rerolled 10,600 tons of 100-lb. rail which was hard to distinguish from new rail. When laid, it rode just as well as new rail and the out-of-pocket cost of rerolling, including a switching charge at the mill, was $11.25 per ton. There is a great opportunity, now that practically all new rail is of 110-lb. weight or heavier, to make a big saving by rerolling rail.

Another improvement that has come into quite general use during the last four or five years has been the reforming of angle bars. With the heavy angle bar we have been using for the last 10 or 15 years and with the comparatively small percentage of the weight of the bar that has been worn away when the rail is relaid or when the bar requires replacing, it was evident that it was a wasteful practice to scrap these bars, as they could be reformed at about one-third of the cost of new bars. In the reforming, if the bars are to be used on old rail, a slight camber is given to the middle to take up the wear of the under part of the head of the rail, while if they are to be used on rerolled rail no camber is required. Two plants are reforming angle bars in Joliet, one in St. Louis, one or more in Pittsburgh and there may be others.

Further Progress in Maintenance Is Needed

It will be noted that much progress has been made in handling maintenance of way work economically in the last few years and there will be much further progress. But if the railways are to continue to perform their part in meeting the transportation needs of the country, they must be prepared to improve their lines and to operate and maintain them in a way that will permit them to compete in rates and service with other forms of transportation. The present age is one of high speed and the main trunk lines of our railways must be improved in ruling grades, alinement, rise and fall and distance, with a track structure that will permit the operation of high speed-trains, both passenger and freight. We think that we are doing well now to operate passenger trains at an average speed of 45 to 50 mi. per hr. and freight trains at 20 to 25 mi. per hr. My prediction is that within another 25 years, all cars, both passenger and freight, will be equipped with roller bearings; through passenger trains will average 60 mi. per hr., and through time freight trains 40 mi. per hr., with the limiting speed of passenger trains raised to 80 mi. per hr., and of freight trains to 50 mi. per hr.

This will require almost perfect track and a high standard of maintenance. It also means that the maintenance forces must be carefully organized and handled, as everything will depend on track conditions, and that we must get away from the idea that the maintenance of way department is only the tail end of the operating organization. It must be a separate organization and handled as such.

Five-ton Caterpillar Tractor with Bulldozer Grading a Spur Track Location on the C. M. St. P. & P.

Plant of the New England Wood Preserving Company at Nashua, N. H.

Where Are We Heading In Timber Preservation?

*A survey of recent trends in treating practices and the use of protected wood**

By GRANT B. SHIPLEY

President, Century Wood Preserving Co., Pittsburgh, Pa.

THE TOTAL quantity of crossties, miscellaneous lumber and forest products of all kinds treated in the United States in 1927, according to the reports of the United States Forest Service, Department of Agriculture, was about 4,150,000,000 ft. b.m. and the forecast for 1928 was 4,400,000,000 ft. b.m. This is about 500 per cent more than 20 years ago. There are further opportunities for increasing the present annual output of treated material by over 300 per cent, since there are prospects of treating a total of 18,000,000,000 ft. b.m. annually.

This increased business cannot be expected from the treatment of crossties, for in 1927 we treated approximately 74,000,000 crossties, the equivalent of 72 per cent of the total number purchased during that year. There are about 400,000 miles of tracks in the United States, containing approximately 1,100,000,000 crossties, of which about 800,000,000 are treated at the present time, leaving approximately 300,000,000 untreated crossties in tracks.

If we assume that 75,000,000 ties are treated annually during the next four years, practically all ties in standard tracks will be treated. However, some of the treated ties which have been in the tracks from 16 to 25 years will have to be taken out, so that it seems plausible to forecast that anywhere from 65,000,000 to 75,000,000 crossties will be required annually for many years to come for maintenance and new tracks.

The more thorough manufacturing, grading and treating of crossties and the better protection against mechanical destruction obtained during the last 10 years will increase their life to a point where we can expect not less than 25 years' service from creosoted and plated crossties. It is apparent that the policy of treating crossties has reduced our total requirements by nearly 60,000,000 ties annually, and it will not be long before annual requirements are reduced by another 25 to 30 million, as those now untreated in track are replaced by preserved ties.

Twenty years ago 82 per cent of all the material treated was crossties. This figure has now been reduced to about 64 per cent; therefore, today 36 per cent of the total material treated consists of miscellaneous lumber and forest products. It is interesting to note that the total quantity of miscellaneous lumber and wood products now being treated, exclusive of crossties, is more than the total quantity of all material treated in 1912 or 1918.

Miscellaneous Uses Growing Rapidly

During the last 10 years the average increase in the treatment of miscellaneous lumber and wood products other than crossties was about 103,000,000 ft. b.m., or 33 per cent annually, and it is apparent that the normal trend in the treatment of miscellaneous lumber and wood products other than crossties will show an average increase of 100,000,000 ft. b.m. annually.

There are further opportunities for using salt treatment, especially where creosote oil is objectionable. There are several well-known salt preservatives on the market, such as zinc chloride, sodium fluoride, Wolman salts, Ac-zol and Z-M-A. These have their merits, especially zinc chloride, for enormous tonnages of zinc chloride have been used in the United States during the last 25 years and there

*Abstracted from a paper presented before the annual convention of the American Wood-Preservers' Association at Louisville, Ky., on January 22.

is no question but that lumber treated with zinc chloride will give good results.

True conservation of wood does not require the substitution of other materials for it. Proper use is all that is required. Treated wood *is* competitive with proposed substitutes; steel subjected to the same influences will rust as quickly as wood decays; cement and clay products, subject to alternate thawing and freezing, ultimately fail. There is scarcely a building material known which does not require special treatment to protect it from action of the elements, and wood, when properly preserved, needs no apologies.

An illustration of the possibilities of adapting wood preservative processes to new requirements is afforded by the recent developments in the treatment of unseasoned hardwoods. After considerable research it has been demonstrated that the Boulton or boiling process is adaptable for the treatment of green oak and other hardwoods without reducing their strength or serviceability and that deep penetration of the preservative is obtainable. More care and supervision must be exercised in the treatment of hardwoods, however, than with fir. Constant and expert attention must be given each charge and the condensing apparatus must be so arranged that the condensate can be observed. Temperatures as well must be under close control to avoid injury to the wood during the seasoning process. Research in the treatment of unseasoned pine by a modified Boulton process gives promise of the accomplishment of results superior to those obtained with the usual steaming practice, and continued studies should make available interesting data. The development of a satisfactory method of preserving unseasoned hardwoods has resulted in the conservation of a considerable quantity of forest products within the last two years, has decreased the user's maintenance expense and has increased the work done at preserving plants.

When the wood-preserving industry is treating 18,000,000,000 board feet of crossties and miscellaneous forest products in the United States annually, we will be conserving at least 36,000,000,000 board feet of timber, or the equivalent of $1,000,000,000 each year. At the same time such a reduction in our timber requirements will save the cut of 15,000,000 acres of forested land annually.

The Trend in Plant Capacities

Twenty-five years ago there were 30 pressure treating plants in the United States, 10 of which were operated by railroads and 20 by commercial or private concerns, whereas today there are 142 pressure plants, 35 of which are operated by railroads and 107 by commercial or private interests.

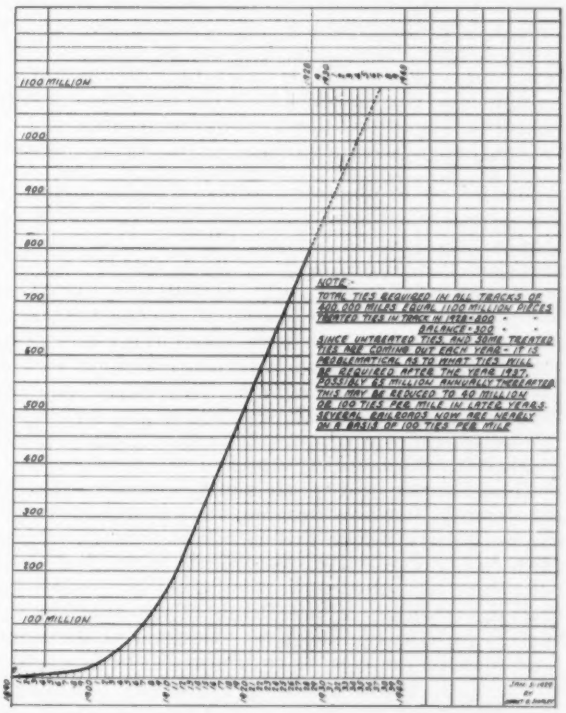
The approximate productive capacity of all of the treating plants now in the United States is around 5,100,000,000 board feet annually, as compared to the actual production of around 4,150,000,000 board feet. Thus, for the present, we have sufficient plants in the United States to take care of all immediate treating requirements. However, some of these plants are not properly located for receiving and distributing treated material at economical costs. Furthermore, many of these plants are old and somewhat obsolete and are, therefore, not efficient or able to handle and do first-class work where high pressures are required.

The railroad-operated plants are producing about 27 per cent of all material treated, whereas the commercial or private plants are producing about 73 per cent. Twenty-seven commercial concerns, operating about 73 plants, treat approximately 68 per cent of all of the material now being treated in the United States.

Creosote Growing in Favor

The trend of treating during the last few years is in favor of creosote oils, about 88 per cent of all materials treated now containing creosote oil, as compared to about 68 per cent 20 years ago. About 13 per cent of all material treated now contains zinc chloride, as compared to about 43 per cent 20 years ago. About 15 per cent of all material is now treated with petroleum mixtures, whereas 20 years ago this was experimental. About 1.7 per cent of all material is now treated with miscellaneous preservatives, principally other mixtures of oils and salts.

The consumption of creosote oils in the United States in 1927 was about 220,000,000 gallons, which



How the Use of Treated Crossties Will Increase
Cumulative annual applications of treated ties from 1890 to 1940, based on the annual treatment of 65 million ties from 1928 to 1938.

is about four times the amount used 20 years ago and about two and one-half times the quantity used five years ago. The estimated consumption for 1928 was around 225,000,000 gallons.

About 60 per cent of all the creosote oil now used is manufactured by domestic tar distillers and the balance is imported, whereas 20 years ago only 25 per cent was domestic and 75 per cent imported.

The by-product coke ovens in the United States make sufficient coal tar to produce around 250,000,000 gal. of creosote oil annually, which is 14 per cent more than the present total annual consumption of creosote oil. However, the steel mills have so far found it more advantageous to burn some of this tar in their furnaces and under the boilers; hence only about 50 per cent of the domestic coke oven tar is converted into creosote.

Under a normal trend, the use of creosote oil will

no doubt increase at the rate of 6,250,000 gal. annually. Thus, for instance, in 1930 the consumption will be around 237,000,000 gal. and in 1940 around 300,000,000 gal.

In 1927 the United States consumed about 22,000,000 lb. of dry zinc chloride, which is about 36 per cent more than was used 20 years ago. The peak consumption was in 1921 when over 51,000,000 lb. were used, occasioned by the high price and shortage of creosote oils. There has been a steady decline in the treatment of material with zinc chloride since then and it appears that in 1928 only about 20,000,000 lb. of dry zinc chloride was used. However, the normal trend may show an increase after 1928 and the forecast is that 40,000,000 lb. or more will be used in 1940.

The choice of the preservative and the process to be used depends on the species of wood, the climate, nature of the roadbed or other service conditions, length of service life expected or required, and the money available for investment in treated material. Progress in the treatment of crossties and timber in the United States has all been in favor of creosote; yet splendid results have been secured from crossties treated with zinc chloride and zinc chloride mixtures; also creosote-petroleum mixtures.

The Use of Creosote Mixtures Is Growing

The Forest Products laboratory tells us that only a moderate quantity of zinc chloride or coal tar creosote is necessary as a toxic. But, in order to get deep penetration and prevent decay through loss of preservative in service and checking and weathering of wood, additional quantities of a carrier for a filler or a solution are necessary. This has been solved by adding petroleum oil, water-gas-tar or coal-tar to either zinc chloride or creosote oil. In 1924 about 11,000,000 gal. of petroleum oil were used in petroleum mixtures, whereas today about 23,000,000 gal. are being used.

About 15 per cent of all material now treated in the United States is treated with petroleum mixtures. Nearly all of this is railroad crossties and timbers. Some railroads which have low cost petroleum oils adjacent to their lines are convinced that the addition of petroleum oil to creosote increases the service life of crossties and at the same time reduces the cost of treatment. The protective effect of the surface coating caused by "bleeding" and subsequent oxidation of petroleum mixtures on the surface of wood so treated adds to the mechanical life of the wood in service through the retardation and prevention of checking, splitting and "brooming." The petroleum coating is sometimes referred to as a weatherproofing or waterproofing agent, but since it is not actually impervious to moisture it is likely that the observed benefits are due principally to the influence of the coating in stabilizing the moisture content of the wood, that is, the prevention of rapid absorption and loss of moisture by the treated wood.

The trend shows a great increase in the use of creosote-petroleum mixtures in railroad materials, wherein from 3 to 4 lb. of No. 1 creosote oil per cubic foot is the basis of the mixture, to which is added from 3 to 7 lb. of petroleum oil per cubic foot, depending on the species of wood to be treated. There is no doubt that splendid results will be secured from such treatment but any reduction of safe toxicity requirements involves great risk if long service from treated materials is expected.

Although our associations and their committees have in many instances opposed the idea of using heavy coal-tar solutions, it is a known fact that for many years solutions containing up to 40 per cent of heavy coal-tar mixtures have been used and have given long life to treated crossties. There are millions of crossties now in tracks which were treated with creosote-coal-tar solutions containing a high percentage of tar, which will give at least 25 years service, a fact which should be recognized when consideration is being given to supplanting a coal-tar with petroleum in regions where ample coal-tar is available.

Plant Improvements

There is nothing very complicated about the engineering problems in connection with this business but we must be constantly on the watch for opportunities to improve the treatment and plants. During the last 25 years considerable progress has been made in improving plant operations and plant equipment. The early plants started off with low pressure treating cylinders 6 ft. in diameter, and for many years it was thought that pressures exceeding 125 lb. were detrimental to the wood, whereas today treating cylinders up to 9 ft. 6 in. in diameter are being used, with a majority of the plants using cylinders from 7 to 8 ft. in diameter for working pressures up to 250 lb. with an average of about 200 lb.

For many years the standard treating cylinder was 74 in. in diameter, having 24-in. gage track therein, and this was thought to be an economical diameter to use. Such cylinders would vary from 100 to 132 ft. in length. About 5 or 6 years ago it was shown that a cylinder 8 ft. in diameter with standard-gage track therein was more economical and today this seems to be about the standard diameter for all plants producing or treating a large variety of miscellaneous wood products. About a year ago the International Creosoting and Construction Company installed what is possibly the largest treating cylinder in the world, which is 9 ft. 6 in. in diameter inside by 166 ft. long, with 1⅜ in. shell plate, constructed for a working pressure of 250 lb. This cylinder will hold a charge of about 2,000 crossties, equivalent to 6,000 cu. ft.

A modern treating plant must be equipped for framing all sorts of timber. Such a plant should consist of cut-off saws, gaining machines, boring machines, trim saws, planers, band mills, etc.

Many purchasers require ties to be adzed and bored before treatment and we have all come to realize that this is a refinement which increases the life of treated wood. Where refractory woods, such as fir, larch and tamarack, are being used, they should be incised before treatment in order to get uniform penetration of the preservative. Where possible, it will help to expedite the seasoning of ties and timber if the incising is done at the saw mill while the timbers are green from the log.

In the past the railroads have been a dominating influence in the wood preserving industry and its success today is largely due to the foresight and initiative of railroad officers, who have saved the users of transportation in this country millions of dollars and at the same time have helped conserve millions of acres of timber land. The railroads are still our best customers but much of their work in wood-preservation is now routine, and tie renewals on many roads are on the decline.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE APRIL ISSUE

1. *What is the best method of insuring that second-hand track material returned to the store department or other central point may be furnished where it can be used to the best advantage?*
2. *When building a new line or making a high raise of grade, what are the relative merits of mudsills and piles for end bents of trestle bridges?*
3. *When the number of ties per rail length is to be increased, either on account of a change in standards, or by reason of a change in the classification of the track, what is the most satisfactory method of effecting the change?*
4. *What is the best organization for handling repairs to pumps and other water-service equipment, including those which must be made in the shops?*
5. *What are the relative advantages and disadvantages of pressed and solid riser plates for switches, from the standpoints of service and effect on the ties?*
6. *What are the relative merits of saw tooth and monitor roof construction from the standpoint of maintenance?*
7. *What are the advantages of whitewashing cattle guards and wing fences? What are the relative merits of doing this work periodically by a small special gang moving over the road on a motor car and by the section gangs?*
8. *To what extent and for what purpose can second-hand car sills be used to advantage by bridge and building forces?*

Preserving Brick Walls

*What is the best method of preserving brick walls which have begun to disintegrate on account of exposure to the weather?**

Paint With Iron Oxide and Linseed Oil

By C. W. WRIGHT

Master Carpenter, Long Island, Jamaica, N. Y.

The only satisfactory means I have ever used to preserve brick walls which had begun to disintegrate on account of exposure to the weather has been to apply a paint composed of iron oxide and linseed oil. This method gave perfectly satisfactory results after washing with acid was found to be of no value.

Should Be Coated to Exclude Moisture

By ENGINEER MAINTENANCE OF WAY

The methods adopted to preserve brick walls which have begun to disintegrate on account of exposure to the weather depend on the expenditure which may be justified and this depends largely on the value of the building and the importance of a good appearance. Disintegration is usually due to the presence of soft bricks and these are often unsightly in themselves before they begin to fail.

For buildings where appearance is essential and the value of the building warrants the cost, a coating of stucco is the best method, since it protects the wall effectively and lends itself to decorative effects by the variety of finishes and colors which may be used. These may be selected to harmonize, or at least not to clash, with the appearance of adjacent structures. For other buildings, painting is the best and cheapest method if care is taken to apply the paint when the bricks are dry so that the proper penetration can be secured.

Much can be done to prevent or retard the disintegration of brick walls by keeping the joints well pointed to prevent the entrance of water between the bricks and by maintaining the gutters and downspouts in good condition to keep the wall as dry as possible.

*For a more detailed discussion see the article "What is Efflorescence?" on page 56 of this issue.

Winter Care of Winter-Laid Rail

What special attention should be given in late winter months to rail which has been laid earlier in the winter?

Much Work Can Be Done to Good Advantage

By W. E. CONNELL

Roadmaster, Panhandle & Santa Fe, Shattuck, Okla.

Rail laid early in the winter requires considerable attention during the late winter if the best results are to be secured. The bolts should be gone over carefully to make sure that each is doing its share toward holding the rail, to prevent slack or expansion at certain joints. It is a little known fact that the weaker joints will get the expansion. The rail anchors should also be gone over carefully and reset so that they will have the same bearing against the ties; this is important and it can be done more satisfactorily in the late winter, when the temperature is even, than at other times.

The seating of the rail should be looked after to prevent any canting caused by uneven bearings, or high or improperly adzed ties; uneven seating causes hard riding track and is injurious to the rail. Close inspection of the tie plates should be made, especially

when rail of heavier section was laid, to prevent "cupping" of the tie plates. Plates showing "cupping" should be removed and the ties adzed properly to provide a good seat for the entire length of the rail. Gage irregularities, that always follow rail seating, should also be corrected. Spike heads that do not exceed one-forth inch above the base of the rail should not be driven down except on instructions of superior officers.

All the work outlined above can be taken care of with a small force and under frozen roadbed conditions. If so handled, it will get closer attention from the foreman, who can, at the same time, check the level and surface in order to map out his program in advance of favorable weather and increased forces and thus be prepared to confine his work on the new rail to improvement of the line and surface.

Keep the Rail Level and Control Expansion

By Roadmaster, Eastern Road

Rail laid in the winter months should be watched closely and all loose ties and uneven places should be kept shimmed. In the spring, when the frost is leaving the ground, the shims should be taken out as soon as possible and all uneven places surfaced.

After rail laying has been completed, the bolts should be gone over and tightened about a week after the rail has been laid and again about a mounth later, to be sure that there will be no loose joints. Expansion should be watched very closely on rail laid in the winter months. All rail should be fully anchored at the time of laying, before traffic is allowed to run over it.

Settling Tanks or Reservoirs?

What are the relative merits of a reservoir or an extra tank for settling turbid water where the daily requirements do not exceed 100,000 gal?

Tanks Are Ususally to Be Preferred

By J. B. Wesley

Engineer Water Service, Missouri Pacific, St. Louis, Mo.

A reservoir has few merits to recommend it in this type of service. In cases where the suspended matter is so fine and of such low specific gravity that settling and clarification are slow, requiring large capacity to permit a long retention period, a reservoir would be preferable to an extra tank, but even in such a case, the sedimentation can be hastened sufficiently, by the proper use of chemicals, to permit the advantageous use of a tank. If the local ground conditions are such that a reservoir can be made by throwing up a small dam and it is not necessary to use a cement lining, the low cost of installation is favorable to the use of a reservoir. Maintenance costs are practically negligible and the length of service obtainable more or less indefinite. On the other hand, the reservoir is more subject to hidden leaks and seepage losses, can not be cleaned so readly, and possesses no materials that can be salvaged for use at other points.

Extra tanks for use as settling chambers are located above ground where any leaks are in the open, are discovered at once, and are readily repaired. Also, by being able to sludge the tank more or less continuously, the period between washings can be extended indefinitely. By elevating the tank, it can also be used as a service tank, thus permitting one handling of the water to suffice. Tanks are not permanent fixtures, but can be moved and relocated as local conditions require. In case the station is abandoned, the tank can be dismantled and re-erected in a new location with little loss. To offset this, the tank requires periodical painting, which is expensive, and the period of service is only 20 to 30 years. All things considered, it is only in cases of exceptionally favorable local conditions that a reservoir is more desirable for use with these small station requirements.

Numerous Factors Must Be Considered

By J. R. Hickox

Hydraulic Engineer, Chicago, Burlington & Quincy, Chicago

In considering this question, the relative cost of a reservoir and of an extra tank must be considered, and also whether the larger capacity of a reservoir is of value to tide over a shortage in supply.

The character and fineness of the suspended matter must be taken into account. Most water, if allowed to stand quiet for several days, will settle so that it is practically clear, although I know of several water supplies that never will settle completely without the use of a coagulant. One reservoir that I have in mind covers 30 acres and is 35 ft. deep at the dam. No water enters it except over the surface from rain and melting snow. It is in a cold country where the winters are long, and yet, after this reservoir has remained frozen over all winter so that not even the wind can disturb it, the water is not clear in the spring. In this case, it was necessary to put in an extra settling tank where a coagulant could be introduced, in order to clear the water suitably for boiler use because the extremely fine material greatly aggravated foaming conditions. This was rather an extreme case, but it is a common thing to have a small amount of extremely fine clay in surface water, that remains in suspension long after the heavier materials have settled out. This is undoubtedly accountable for a good deal of foaming trouble.

A large irrigation reservoir covering about 6,000 acres and 200 ft. deep at the dam, which catches its water directly at the foot of the mountains, never has clear water flowing from it, although before the dam was built, the stream below it was always clear and sparkling, except in flood times. This is owing to the fact that, as it originally ran, the muddy water passed down the stream during high water and during the regular flow only the spring or ground water was in the channel, but when the muddy water is impounded there is a small amount of suspended matter that does not settle out. In some cases, this is so fine that it can not be filtered out with filter paper. A suitable coagulant, however, will form it into flocs and settle it out completely. This can usually be done better in a tank than in a reservoir.

The chemical character of the water has much to do with the kind of coagulent to be used and the success that will be had with it. If the water needs other treatment, as most natural waters do, the water can be treated and the mud taken out in the same settling tank with very little added expense for the treatment.

The kind of water taken into the boiler on the remainder of the engine run has a bearing on the amount of solids that can be taken with this particular supply without running the total too high. Another factor is the importance of the service in which the engines are working. There is very little money saved in carrying a refinement beyond a point where

benefits are necessary. In a service where the engines are being worked to their maximum capacity, it pays to spend more money to put the water in a more nearly perfect condition than on a line where the service is light and a certain amount of trouble in the boiler would not interfere with the duty it is called upon to perform.

The topographical features of the location of the reservoir or tank site are of importance since there must be a place to dispose of the sludge coming from the tank when it is flushed. There must be an economical location for a reservoir in soil that does not seep badly, and, if possible, it should be located in a small drainage area, where no large amount of muddy water will have to pass through it, keeping it stirred up and increasing the rate at which it fills with mud.

Where only a small sedimentation reservoir is required, this can sometimes be secured by excavating a basin of the desired capacity, if the soil is suitable, in which case coagulents and other treatment can be applied the same as in a tank. In this case, it is a question of relative costs, topographical conditions and appearance. A tank is more flexible in location, and where algae growth occurs, it is more troublesome in reservoirs than in tanks.

Fastening Guard Timbers

What are the relative merits of the various methods of fastening guard timbers to the ties on bridges?

Bolts Give the Best Service

By A. F. Robinson*

Bridge Engineer, Atchison, Topeka & Santa Fe System, Chicago

I have used full-bolted connections for guard rails, sway braces and similar members for many years and prefer them to lag screws or any other method. I have never used lag screws, as I have always been afraid of them, and prefer a bolt passing entirely through the timbers. On a line running into St. Paul, Minn., when the guard rails were fastened to the ties with 10-in. boat spikes, I found that the boat spikes as well as 12-in. drift bolts pulled out during the winter, owing to the action of the frost, so that the heads of the spikes stood from two to three inches above the guard timbers. The spikes holding the bracing in place also gave trouble in the same way.

So far as the fastening of the guard rails is concerned, I do not think any method is successful unless it is used with a reliable tie spacer which will not be affected by shrinkage of the timber. We use special spacers for this purpose, which are placed on each tie under the guard rail.

Lag Screws Are Effective When Applied Properly

By Supervisor of Bridges

Of the three methods commonly used for fastening guard timbers to bridge ties: boat spikes, lag screws, and bolts passing entirely through the guard timbers and ties and held in place by nuts, the first is the cheapest and also the least efficient, since the spikes have little holding power compared with either lag screws or bolts. While guard timbers are used primarily for the purpose of keeping the ties properly spaced, they must sometimes act as guard rails, especially on open-deck timber trestles where there are no inner guard rails, and for this reason they should be fastened securely enough to prevent their being torn out by derailed trucks. Guard timbers fastened with boat spikes should be dapped over the ties and the labor of doing this nullifies a large part of the savings effected in the cost of the lag screws and the labor of installing them.

Lag screws, when applied to every tie as recommended by the A. R. E. A., fasten the guard timbers securely to the ties and dispense with the necessity of dapping the timber over the ties, or the use of tie spacers to prevent the bunching of the ties. A variation of this method which gives good results is to use lap joints over a tie at the ends of adjacent guard timbers and to use a bolt through the joint and tie, in order to resist the tendency of the lag screw to loosen at this point, owing to the leverage of the timber under passing loads. In applying the lag screws, they should be screwed into bored holes slightly smaller than the size of the screw, since if they are driven into place the fibers of the wood will be injured and lose their holding power.

When bolts are used, it is common practice to apply them at every third or fourth tie and in such cases it is necessary either to dap the guard timber or to use spacing blocks between the ties. If the bolts are applied to every tie, the cost is somewhat more than for lag screws. On the other hand, the bolts will hold the guard timber more firmly than will the lag screws if the nuts are kept tightened, but this feature entails more attention than in the case of lag screws.

Of the three methods, lag screws will give the best service at the lowest cost when applied and maintained properly.

Drainage of Turnouts in Flat Yards

What is the best method of providing drainage around turnouts in a ladder track in a flat yard? How can this best be done when it is not feasible to provide a complete underground drainage system?

Drainage Should Be Carried to Sumps

By A. M. Clough

Supervisor of Track, New York Central, Batavia, N. Y.

In a flat yard which is level and which has no underground drainage system, there is only one way to keep the switches and frogs free from water and that is to keep the ballast low enough beneath the base of rails so that water from heavy rains or melting snow will be below the rails. From these low points a light gutter must lead to a hole lower than the lowest part of the depression under the switch and frog. This hole must be covered over and as it fills, the water must be dipped out so that the drainage will continue. This method will also keep any ice that may form under the switch rails low enough so that it will not interfere with their movement.

Depends on Local Conditions

By A. Rost

Supervisor, Baltimore & Ohio Chicago Terminal, Chicago

In flat yards where there is no underground drainage system, a good method is to dig a ditch parallel to the ladder and 20 ft. away from it, sloping the ground from the track to the ditch. This will drain the turnouts and at the same time leave a dry runway for the switchmen. If the ground cannot be sloped, a small drain must be put in at each turnout, for which purpose old engine tubes can be used to good advantage.

*Died January 20, 1929.

In locations where there is a sandy subgrade and a ditch is not feasible, a fairly good drain can be made by burying a barrel in the ground at each switch. The bottom of the barrel should be removed and the top should be perforated, the barrel being buried so that its top is level with, or slightly below, the lowest point to be drained.

All Conditions Must Be Taken Into Account

By Roadmaster

The drainage of turnouts in a ladder track in a flat yard where no complete drainage system is provided depends on local conditions. When the ladder is along the outer side of the yard, the cheapest and most satisfactory method is to carry French drains from the turnouts to the side of the fill or into the ditch, depending on whether the yard is in a cut or on a fill.

Ladders in the interior of a yard present more difficulties. Where the yard is on a fill of impervious material overlying a porous natural ground, French drains may be installed, leading to what might be termed vertical French drains, consisting of excavations through the filled material to the pervious ground below, the excavations being filled with stone or coarse cinders such as are used in ordinary French drains.

In other cases, where the ladder is located in a cut or on impervious filling materials overlying other impervious material, it is sometimes necessary to lead French drains or drain tiles to a sump, which must be bailed out as the water accumulates. These sumps may be made of old oil barrels and should be installed so as to prevent the entrance of surface water as much as possible.

The number of vertical French drains or of sumps will depend on a balancing of the cost of installing them and of the drains leading to them. When the yard is level, they may be placed at or near the center of several turnouts in the ladder, thus decreasing the excavation necessary for the drains.

Encasing Steel with Concrete

What precautions should be taken to insure a bond when encasing members of a steel span with concrete?

Reinforcement Must Be Ample and Clean

By L. W. Skov

Office Engineer, Bridge Department, Chicago, Burlington & Quincy, Chicago

Members in steel spans which are to be encased in concrete should preferably be painted to insure clean surfaces in contact with the concrete. In addition, holes should be provided through the webs of beams through which reinforcement can be fastened rigidly. Sufficient covering is essential to permit working the concrete around the beams and reinforcement. Reinforcement in the form of bars around the corners of the flanges is necessary to prevent cleavage due to contraction of the encasement while setting and drying out, as well as to provide for the stresses set up on account of unequal temperature coefficients of the two materials.

Experience shows that wire is not a suitable material for reinforcing around the flanges as the wires are not of sufficient cross-section to withstand the stresses set up at the edges of the flanges without yielding sufficiently to permit the forming of cracks. Where light reinforcement is used, cracks are sure to develop at the flange corners and this is especially true in members subject to bending stresses. Flanges of the steel beams should be kept as narrow as practicable and sharp corners in the encasement should be avoided wherever possible.

The concrete should be dense to insure against absorption, and when the encasement is used as a bridge deck the upper surface should be covered with membrane waterproofing.

Depends on the Functions of the Encasement

By A. N. Laird

Assistant Engineer, Grand Trunk Western, Detroit, Mich.

It is necessary to divide the consideration of this subject into two classes: 1—Beams encased with concrete in which the encasing material is provided for rigidity and protection against deterioration, and 2—Beams encased with concrete where the concrete is designed to form an integral part of the structural member and to take a definite portion of the load.

Under the first classification there may again be several groups:

(a) Where the beams are closely spaced and the concrete is poured solid for the full depth of the beams, I do not believe any special precautions are necessary to insure a bond between the concrete and the steel sufficient for the purpose, except in cases where the lower flange is also included in the encasement and this would require a moderately heavy mesh reinforcement with metal ties extending up into the concrete between the beams.

(b) Where the beams are spaced some distance apart and the concrete construction consists of a slab over the top portion of the beams with encasement around the beams, special anchorage is necessary to insure bond. Where the encasement extends to the top of the lower flange of the beams only, it is desirable to have the webs of the beams perforated at intervals of from 18 to 24 in., with "U"-stirrups passing through the holes and extending above the top of the steel beams into the concrete slab. These stirrups in turn serve as supports and anchors for longitudinal bars through the encasement.

(c) Where the encasement extends around the bottom flange, it may not be necessary to perforate the web of the beam, since the same effect may be had by using a heavy bar-stirrup passing around the lower flange on the beam, crimped close to the web, and from there passing above the top of the beam into the main slab. This serves the same purpose as the stirrup of the encasement in the previous class. The mesh reinforcement should then be used for the bottom flange and this should be attached to the stirrup, as indicated for longitudinal bars.

Under the second general classification, where the concrete forms an integral part of the beams and is designed to bear its portion of the load, the problem is somewhat different and requires more careful consideration. In the case of small steel units, such as steel gratings, probably no special method of bond is necessary since the size of various portions of the concrete is so small as to make the contraction or tendency to pull away from the encased unit negligible. In larger units, such as beams, however, shrinkage when the concrete sets is generally sufficient to break the bond and to prevent the entire encased section from acting as a whole, unless special bonding means are provided. Available information on this subject is rather meager; however, the tests which have been made seem to indicate that there is a marked advantage to be obtained from the combining of concrete and steel as a structural material and

"U"-stirrups at close intervals through the webs of the beams combined with longitudinal bars should be used. The design of the combined material as a unit is outside the scope of these notations.

The above remarks have been largely applicable to beams. However, the problem of encasing steel columns, struts, and tension members is quite similar and more readily taken care of, owing to the possibility of passing reinforcing bands around the members to serve as ties, in much the same manner as lateral bars would be used in the design of a reinforced column.

Where an actual integral bond is desired between the steel and the concrete, the steel should be unpainted and should be thoroughly cleaned of all grease and dirt as well as mill scale and rust. Where this feature is not of such importance, however, it is desirable to paint the steel with one coat of red lead and linseed oil before encasement, particularly in the case of separate units not incorporated in mass construction, since this will be an added protection for the steel against the possibility of the concrete being porous and permitting absorbed water to act on the steel and deteriorate it.

Engines for Motor Cars

What are the relative advantages and disadvantages of air-cooled and water-cooled engines for motor cars under different climatic conditions and for different kinds of service?

Each Type Has Certain Advantages

By C. H. Ordas
Supervisor of Motor Cars, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Air-cooled engines, when properly designed, especially for proper radiation, are as efficient as water-cooled engines, regardless of service, with the advantage of lightness. Many types of air-cooled engines are very efficient, particularly on direct-drive cars, where radiation is obtained by the proper "finning" of the cylinder. Some types of belt-driven cars also use air-cooled engines satisfactorily, these being rigged with a fan and housing. Air-cooled engines, of course, are more desirable in cold sections of the country.

Water-cooled engines of some types are in many cases much heavier, and in some cases more difficult to service, especially as regards dismantling and reassembling, owing to the need of numerous gaskets, which, if not at hand, must be cut by the person doing the work. If this is not done properly, it causes trouble. However, water-cooled engines offer a greater margin of safety for heavy work or where the weather is very warm.

Depends on Service Rather Than Climate

By A. Perry Everstine
Engineering Department, Norfolk & Western, Roanoke, Va.

The rule which experience dictates in the choice between air-cooled and water-cooled motor cars is that the air-cooled car is preferable where no special operating conditions prevail in which air-cooling is inadequate to the demands of the motor. For such service as for bridge and extra gangs where heavy trailer loads of men and materials are hauled, in hump-yard service where the car is in continuous operation at slow speeds and under load on the up-grade haul, and in special service where the car is required to pull weed-burning equipment, track oilers, ballast-dressing machines, etc., and to operate tie scorers, portable saws, air-compressors, generators, mowing machines and the like, the water-cooled machine is preferable for all-year service, regardless of climatic conditions.

For ordinary section-gang use, in the service of signal and telephone maintainers, and for inspection services, the air-cooled car has been found more efficient because of its lighter weight, its greater freedom from attention on account of fewer parts, and its freedom from freezing hazards. As in the case of the water-cooled car, the air-cooled machine, in the services indicated, will perform efficiently the year round in all our various domestic climates.

The deciding factor in choosing between air-cooled and water-cooled motor cars is the class of service to which the particular car is to be assigned, rather than an anticipation of seasonal or climatic conditions under which the equipment may be operated.

Removing Heavy Snow Falls from Large Yards

A further answer to a question discussed in the December issue:

What is the best method of removing heavy falls of snow from large yards?

Modern Equipment Is Neccessary

By J. W. Powers
Supervisor of Track, New York Central, Rochester, N. Y.

In discussing the methods of removing snow from large yards, it is assumed that modern snow-fighting equipment, such as rotary snow plows, double-track wing and flanger plows and air-operated spreaders are available. If it is permissible or possible to deposit the snow on the land adjacent to the yard and the snow is very deep, the quickest way of removing it from the outside tracks is by means of a rotary plow. A flange car should follow the rotary so as to leave the track practically free from snow. The rotary should be equipped with wings so that no snow will be left between the tracks. The modern rotary plow is capable of throwing the snow over several tracks so that it will not have to be handled the second time.

In removing snow where it is necessary to load it on cars, perhaps the quickest method is to use a double-track plow with a spreader back of it. This equipment will clear two tracks in one operation, as the spreader should be long enough to remove the snow from tracks adjacent to the one on which the plow and spreader are being operated. This second track will be in condition for the outfit to back up on so that it will not be necessary to back up on the one that has been plowed, since in backing up on the plowed track, the nose of the plow will destroy, to a great extent, the effect of the flanging. Then the outfit can be pushed ahead again on the second track and this operation repeated until the snow has been removed from several tracks and left piled on one or more tracks, which must be put out of commission until the snow has been loaded on air dump cars by clam shells, steam ditchers or both. If sufficient power and equipment are available, the rotary plow could be in operation on the outside tracks while the other equipment could be used on the other tracks. This procedure would necessitate sufficient motive power to remove the cars if there are any on the tracks from which snow is

to be taken, and it is frequently necessary to remove some of the snow by hand from between and underneath the cars to prevent them from being derailed as they are being moved.

While the problem of supervising such equipment in the removal of snow would seem to be a very simple one, a note of warning should be sounded. This is that the man in charge should be thoroughly familiar with the work in hand. Such familiarity can only be acquired from years of experience and actual participation in this work, for only as the result of such experience will one be capable of meeting any contingency which may arise, despite the best laid plans.

Selecting the Operators for Motor-Driven Machines

What are the qualifications for operators of motor-driven labor-saving devices? What can be done to secure men with the proper qualifications for this class of work?

Should Be Intelligent and Know Railway Work

By Earl H. Mills

General Gas-Engine Inspector, New York Central, Lines East, New York

The qualifications for operators of motor-driven labor-saving devices are briefly the ability and the will to get at minimum cost all the work from his machine of which it is capable. A man fulfilling these requirements must be in good physical condition, have some mechanical ability as well as some railroad experience and must not be lazy. Very few men who have operated machines are available and the problem arises in the necessity of training green men. The position of operator should be a promotion for some one who previously performed by hand the same work the machine is to do. This is in line with the established policy of most railroads of promoting men within the ranks to better positions as they open up. The field is large, but rather barren, and the question of seniority is always present. This should be a consideration only where two or more men seem to have the necessary qualifications.

The most satisfactory practice is to take likely, energetic young men with some mechanical aptness who have been long enough in track or other service to have railroad background and experience. Such men are usually available from the various gangs and are known to supervisors, foremen and particularly to the mechanics who repair motor cars, tie tampers, etc. They are always glad of the opportunity to earn more money and get away from the drudgery of a laborer's job.

After a man has been selected, he should understand that his increased pay is dependent upon his ability to produce results with the machine he has been assigned to run and that favoritism or friendship will not excuse him if his work is unsatisfactory. The next step is to see that he is fully informed concerning his machine. This instruction must be complete, but not too intensive. It should be spread over a period of several days in order to be fully absorbed. In addition to factory service instruction, supplemented by the usual instruction books, the local mechanic in charge of repairs should visit the machine frequently during the first season and amplify on the necessity of care in lubrication, inspection, cleanliness, etc., and the difficulties arising from the neglect of making minor repairs and adjustments promptly. This is as much a part of a mechanic's work as making repairs and he should realize it. Much depends on the mechanic at this stage and, if he has been given a hand in selecting the man, the training will be much more effective. To make his own work lighter, the mechanic desires to keep the machine working and knows that timely instruction will accomplish this desirable result. Therefore, his opinion in the selection of men should be sought and his services employed for instruction as well as repairs.

If the practice as outlined above is followed consistently as new equipment is added, it will result in efficient use, low costs and general satisfaction. It will promote a better feeling among the men and will attract others who will remain in the expectation of getting better pay where before the chances were much more limited. The selection of future operators will then be relatively easy.

Select Bright Young Men and Train Them

By A. Chinn

Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Operators of motor-driven labor-saving devices must be above the average in intelligence and resourcefulness. They must have a mechanical knack and thoroughly understand the principles of motor-driven machinery. They usually work at locations that are far removed from shop facilites and the immediate help and advice of their supervisors, hence they must be capable of meeting emergencies and conditions as they arise in the field and of handling them without explicit directions or help. Since they do not always have daily supervision, they must be loyal and conscientious about their work and always be ready to give a full day's work without the supervisor standing over them. It is also important that they have a proper regard for safety. They must often work in places that are more or less dangerous and in co-operation with other men, so that the safety of themselves and their fellow workmen will depend on their care and vigilance.

As their work is of a strenuous nature that requires considerable moving about, it is desirable, though not essential, that they be young men. Bright young men to train for these positions can usually be secured locally along the railroad, or from laborers in the section and bridge and building gangs, who show promise of development. As a rule, it is best to select men about 20 years of age, as they are more easily trained. These men can be sent out as oilers or pitmen with some of the older operators, who can take them in hand and teach them the elements of handling and caring for the machines. If aptitude is shown, the beginner, after a reasonable period of time, should be allowed to operate some simple device, such as a gas-driven rail drill, that does not require much training or create a hazard or serious loss if improperly handled. If his work continues satisfactory, opportunity should then be given him to operate a somewhat more complicated machine, such as a small power rail layer or a gas-driven weed burner. At the end of the maintenance season, these men can be brought into the shops to assist in repairing the machines and to acquire a more intimate knowledge of the mechanical details, which will enable them to care for the machines and make field repairs to better advantage.

In this way a man is educated and stepped up as

his capabilities develop until he can handle any machine that it may be necessary to put him on. During the period of development, the supervisor should watch the progress at all times and if it is found that a man is unsuited for the work, either through lack of capability or indifference, he can be dropped at some time when work is slack before he reaches a point where he can cause trouble or loss for the company.

Frequent Supervision Is Essential

By Lawrence A. Luther
Sales and Service Engineer, Ingersoll-Rand Company, Los Angeles, Cal.

The recruiting of fairly competent and dependable operators for modern work equipment is a problem which varies with the locality and the class of labor available, because of which no fixed rules can be applied. The problem is usually complicated by the fact that much of the work to be handled is seasonal. On rail cranes and similar equipment where the efficiency of the machine and the avoidance of personal injury to men is in direct ratio to the operator's ability, capable, adequately-paid operators are the only solution. A careful study of particular situations, with a view of assuring these men year-around employment, is essential.

On lines operated through agricultural or undeveloped country, the scarcity of employment usually induces an excellent type of native young men to accept almost any opening with railroads. Many roads recruit not only high-class operators, but a large percentage of their best foremen from this class. In territory adjacent to cities or where raw foreign labor is the only sort which can be obtained except at prohibitive wages, the obtaining of suitable operators at the modest wage allowed is apt to prove difficult.

Under these conditions, it would seem that the only solution is to confine the education of operators to doing as they are instructed, and to give special attention to the perfecting of an adequate organization for the maintenance and repair of work equipment. If high-class men are employed to act as mechanical maintainers and their territory is such as to permit of their visiting every piece of equipment frequently, their instructions to operators and their checking of the condition of the machines usually pay better dividends than the expenditures involved in hiring near-mechanics as operators. The misadjustments made by more or less conceited, but actually incompetent, operators are a prolific source of trouble. Mechanical supervisors and their assistants, who combine energy and ability with reasonable tact in dealing with their work, are becoming an increasingly essential factor in the railroad organization.

Injury to Ties by Tamping

A further answer to the following question discussed in the November, 1928 issue:

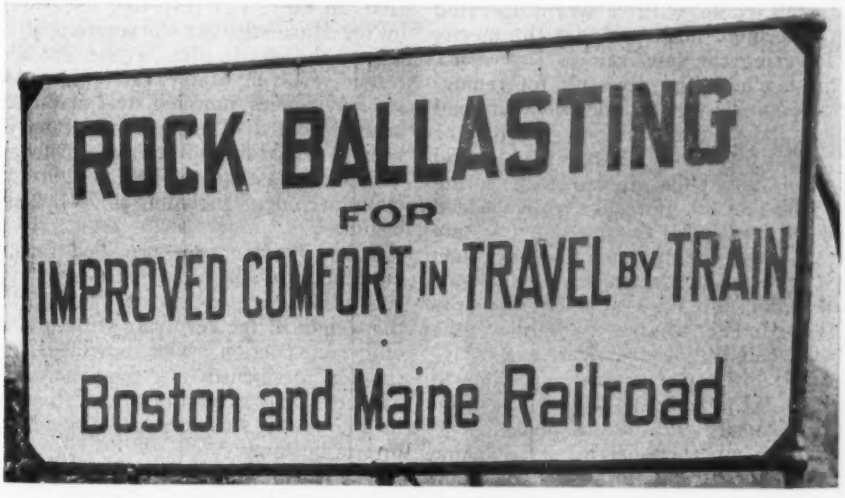
To what extent are the bottoms of ties, particularly those of soft woods, damaged by tamping What practical means can be used to prevent this damage?

Most Damage Is Done by Hand Tamping

By F. J. Meyer
Assistant Engineer, New York, Ontario & Western, Middletown, N. Y.

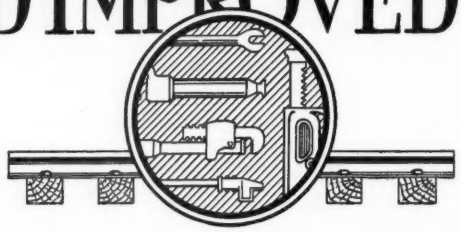
The question refers specifically to the bottom of ties and was not an uncommon one prior to the advent of mechanical tie tampers. It bears out the general opinion that it is difficult to secure properly "hand-tamped" stone ballast. Inexperienced men, working with ordinary tamping picks, do not drive the stone under the ties. This results in the track having to be constantly "picked up" where low spots naturally follow. Moreover, when done by gangs made up of experienced and inexperienced tampers, the experienced men usually try to work between the rails where the least tamping is required, leaving the ends, where the tamping must be thorough, to the inexperienced.

Where track is tamped with mechanical tampers, the tool is started in a nearly vertical position at the side of the tie, the ballast being worked down gradually so that the tamping tool does not come in contact with the tie but crowds the ballast securely under it, giving a uniform bearing to all ties tamped. This distributes the work that each tie has to do so that no individual tie is damaged from overloading or from churning.



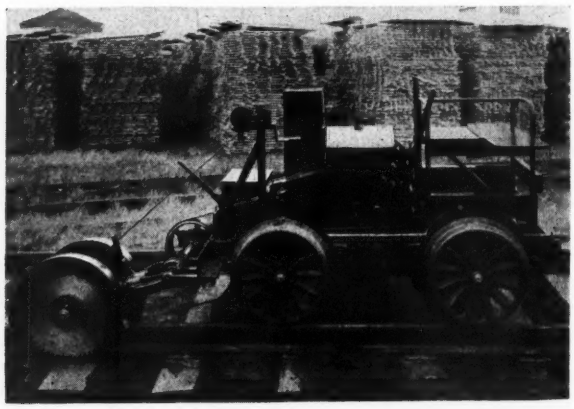
How the Boston & Maine Advertises Its Maintenance Operations

New And Improved Devices



Woolery Introduces a New Tie Scoring Machine

THE Woolery Machine Co., Minneapolis, Minn., is now manufacturing a tie scoring machine which possesses a number of distinctive features. It is mounted on a portable power plant, which is essentially a motor car with a steel frame, equipped with an engine that has a two-speed transmission; a high speed for propelling the car and a low speed for operating the saw. The saws are mounted on a pivoted frame or bracket with a belt drive to a jack shaft on the pivot center and a chain drive from this jack shaft to the



The Woolery Tie Scorer

saw shaft. A small cable with a worm-operated drum at the top of a small mast provides the means for raising and lowering the saw frame.

In designing the machine, the necessity for removing it from the track quickly was kept definitely in mind and on this account the machine has only one pair of saws. Another reason for using only one pair instead of a set for each rail, is that the saws of a tie scoring machine frequently hit the stub of a spike, an embedded stone or other obstruction, and if the operator has only one pair of saws to watch, he can guard against such obstructions much more readily than if saws are operating over each rail at the same time. Also less power is required for operating one set of saws. This allows the machine to be built sufficiently light that it can be removed from the track by two men. It is possible to change the spacing of the saws by means of metal washers which are furnished with the machine.

The saws are a very important part of the machine and have been improved materially through co-operation with the saw manufacturers. Saws with inserted teeth are used so that the diameter of the saw will not be continually decreased when it is sharpened. The teeth are of an improved type to enable the saw to stay in the machine for the longest possible time before it has to be sharpened and also to increase its life. Extended experiments with various types of special metals resulted in facing the saw teeth with a special, tough, hard alloy which resists the abrasive action of the cinders and grit in the ties and yet is not brittle and does not chip off.

The amount of scoring that can be done with one of these machines depends, of course, on many factors, the most important of which are the condition of the ties and the kind of wood from which they were made. White oak ties are much harder to cut through than soft wood and if the ties are badly rail cut, the work will proceed more slowly. As a matter of fact, a mile of track ties can be scored on both sides with this machine under the most severe conditions of bad ties and heavy sawing, whereas under the best conditions, two or three miles of track may be covered with the use of one of these machines in a day's time. On heavy rail-laying programs, it may be desirable to use two machines, one cutting on one rail and the other cutting on the other, to cover the job in the shortest possible time.

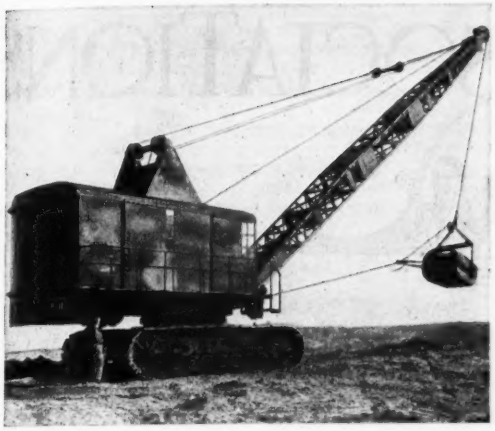
A New Excavator

A NEW excavator of 3½-cu. yd. capacity has been added to the line of gasoline, Diesel, and electric powered shovels, draglines, and crawler cranes manufactured by the Harnischfeger Corporation, Milwaukee, Wis. It is known as the Model 900, and its general design closely resembles that of the four smaller cast-steel machines built by this manufacturer. Its over-all width is 14 ft. 6 in. and the over-all length is 25 ft. Like all other full revolving excavators manufactured by the Harnischfeger Corporation, it is convertible for use as shovel, dragline, crane, etc.

The revolving frame, car body and corduroy frames are single-piece annealed steel castings, machined at the bearing points. The revolving frame of the Model 900 weighs 17,000 lb. and its over-all length is 19 ft. 6 in. This large casting provides a rigid foundation for the main machinery, including a 175-hp., six-cylinder Diesel engine.

Roller bearings are provided throughout the main machinery of the upper structure. The four double sets of swiveled, conical steel swing rollers, which carry the weight of the revolving structure, are also provided with anti-friction roller bearings. All gears of the traction mechanism are completely enclosed in heavy cast steel gear cases and run in a bath of oil. Bearings in the lower structure are provided with renewable bronze bushings.

The new machine is provided with a box-girder shovel boom, outside dipper sticks and a 3½-cu. yd. dipper. It is also provided with a 3½-cu. yd. bucket for dragline work. Smaller buckets are provided when the



The New P. & H. Model 900

nature of the work makes it necessary to use booms of unusual length.

The Model 900 is said to be exceptionally mobile for an excavator of this size. Steering brakes are provided, making it possible to turn the machine squarely around or in any desired radius. The tractions are gear driven and are of the P. & H. double-sprocket, non-clogging type.

Use Timken Roller Bearings on a Heavy Turntable

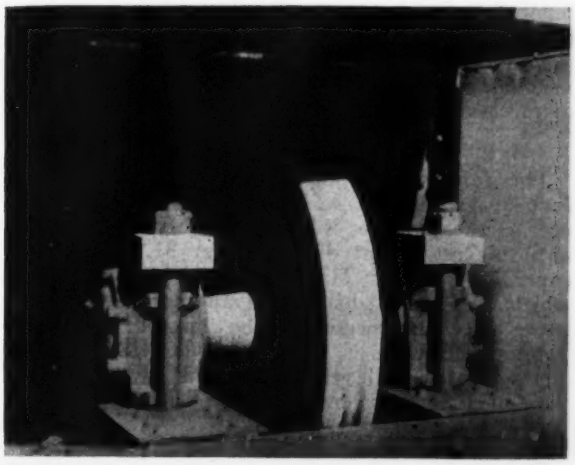
IT IS of interest that tapered roller bearings, which had one of their earliest applications in the center bearings of turntables, are now being applied also to the axles of the end trucks. The American Bridge Company, which developed a tapered roller-bearing center many years ago, is now using roller bearings on the end trucks of its tables of the continuous-girder type.

In this type of turntable, the end trucks carry a considerable portion of the dead and live load while being turned. Consequently, bearing friction in the end trucks has a pronounced effect on the amount of power consumed in operating the tables. This, naturally, suggested the application of a low-friction type of bearing, and Timken bearings of the type now being used on railway car trucks were selected for this use.

Each truck consists of two units, fastened to the main girders in such a way as to permit a certain amount of rotation around the point of connection. Each truck unit is provided with two standard 36-in. Carnegie rolled steel wheels, the flanges of which have been removed. The method of mounting is such that the truck frame is suspended from the axles, the whole weight of the truck and its proportion of the table load being taken by the roller bearings with which the truck wheel axles are equipped. An idea of the method of mounting can be obtained from the illustration, which shows one of the trucks of a 100-ft. turntable, installed at an enginehouse of the Southern Pacific at Houston, Tex., that are equipped with Timken bearings. The loads per truck range from 165,000 lb. for the static reaction occasioned when an engine comes on the table, to a maximum turning load of 125,000 lb.

The driving mechanism at each end, consisting of a 15-hp. back-geared induction motor, and the necessary intermediate gears, is mounted on a cantilever extension on the off-truck frame. This mounting has the effect of increasing the dead-load reaction on each of the driven wheels to a point where there is no danger of slipping the wheels when the unloaded table is accelerated rapidly and eliminates the necessity for sanding the pit rail, even in wet weather. The main drive pinion is mounted on a sleeve that is normally held in place by a set screw. Loosening of the screw permits sliding the pinion out of mesh with the main driving gear, so that the table can be turned manually without working against the inertia of the motor armatures and back gears.

Since the installation of the table, several interesting facts have developed concerning its operation. In the first place the use of Timken bearings reduced the initial horsepower requirements per motor from 25 to 15 hp. On the basis of the number of table movements made per day, the saving in power consumption alone is said to have been enough to pay the increase in investment represented by the bearings. The reduction in friction thus obtained, coupled with the provision for disconnecting the driving mechanism described above, have



Close-up of One of the Truck Wheels Showing the Method of Mounting the Roller Bearings

been directly responsible for the elimination of another expense, that for the initial cost and upkeep of emergency turning equipment, such as compressed-air or gasoline motors for it has been found that six men can turn the table by hand when it is unloaded and that 12 men can turn it manually when it is loaded with a heavy locomotive.

Welded Steel Ties Installed by the D. & H. in a Turnout at the General Electric Plant at Schenectady, N. Y.

WITH THE ASSOCIATIONS

The Roadmasters Association

All copy for the proceedings of the convention held in Detroit last September is now in the hands of the printer, and the bound volumes will be mailed to members as soon as the printing and press work have been completed. The chairmen of committees which have been assigned subjects for study and report at the convention in September have been urged to take up their work promptly in order that preliminary reports of progress may be made at a meeting to be held in Chicago during the exhibit of the American Railway Appliances Association.

Maintenance of Way Club

The January meeting of the club was held on January 16 when C. A. Morse, who was chief engineer of the Chicago, Rock Island & Pacific System, until his retirement on December 31, presented a paper on "Better Maintenance at Lower Cost," which appears in abstract on another page of this issue. The next meeting of the club will be held on February 20, when C. W. Gennet, Jr., vice-president of the Sperry Rail Service Co., will give a talk on the detection of transverse fissures.

Metropolitan Track Supervisors' Club

The next regular meeting of the Metropolitan Track Supervisors' Club will be held on Thursday, February 14, at Keen's Chop House, 72 West 36th street, New York City. Under the arrangement started at the last meeting, luncheon will be served at 1 p. m., and will be followed by the regular business. The subject for consideration at the meeting will be "Track Lining and Surfacing," and the discussion will center around a report to be presented by a committee composed of P. J. Hurlihe, N. Y., N. H. & H., chairman; M. C. Martin, N. Y., N. H. & H.; W. R. Parvin, Penna.; P. R. Bickford, Reading; A. F. Doyle, Erie; J. Johnson, N. Y. C.; and T. H. Egan, C. R. R. of N. J.

International Track Supervisors' Club

The next regular meeting of the International Track Supervisors' Club will be held on Thursday, February 21, at the Hotel Statler, Buffalo, N. Y. Luncheon will be served at 12:30 p. m., following which the meeting will be called to order by R. T. Davis, division engineer of the Erie, who was elected president of the club at its November meeting. Other officers elected at that time included J. Fitzgerald, supervisor on the B. R. & P., who was made vice-president, and Charles G. Ericson, who was continued as secretary-treasurer.

At the February meeting it is planned to continue the discussion of the subject presented at the last meeting, "One-Piece Manganese Guard Rails," and it is also expected that two papers will be presented to the club, one on "Labor Camps and Their Care," by D. Trapani, labor agent at Buffalo, and the other on "Care of Right-of-Way, Fences, Ditches and General Appearances," by W. H. Connolly, track supervisor on the Erie.

American Railway Engineering Association

In accordance with a plan put into effect by the Board of Direction, the assignment of work to the committees and selection of committee personnel was completed in time for publication in a bulletin issued to the members during the middle of last month, thereby advancing the date at which committees are in a position to commence work fully two months over last year. That the committees are taking full advantage of the opportunity thus afforded for starting their new work in advance of the presentation of reports on their current assignments next March is indicated by the fact that three committees have already held organization meetings. The Committee on Yards and Terminals met at Buffalo on January 20 and 21; the Committee on Water Service held a meeting at Chicago on January 23; the Committee on Iron and Steel Structures held a meeting on February 1, while the Committee on Uniform General Contract Forms, is scheduled to meet in New York on February 4.

The Committee on Arrangements for the 1929 convention held a meeting on January 22 as a result of which notices to members covering the reservation of places at the annual dinner were mailed on January 28.

The subjects assigned to the various committees, together with the names of their chairmen, follow, with the subjects assigned for the first time shown in italics.

Roadway—Study and report upon methods for laying and maintaining tile and other drains along railway track or roadbed under varying conditions; study and report on improved methods for preventing corrosion of fence wire; study and report on permanent roadbed construction, collaborating with the Committee on Track; *study and report upon methods and devices for weed killing;* study and report upon drainage areas and water runoff and the proper sizes of waterway openings required under the differing conditions in various parts of the country; study and report on specifications for cast iron pipe, corrugated iron and other types of metal culverts; *study and report upon the use of highway crossing plank and substitutes therefor,* collaborating with the Committees on Track and Grade Crossings; *collaborate with Special Committee on Clearances in preparation of clearance diagrams for recommended practice.* C. W. Baldridge, assistant engineer, A. T. & S. F., Chicago.

Ballast—Conduct tests and continue study of washed gravel ballast to determine the best method of testing for hardness, abrasion and resistance to weathering in order to provide specifications therefor; study and report on comparative merits of ballast materials and their effect on operating costs; study and report on shrinkage of ballast; *determine the answer to the question: What is ballasted track?* E. I. Rogers, chief engineer, P. & P. U., Peoria, Ill.

Ties—Complete investigations and make final report on anti-splitting devices; investigations and report on extent of adherence to standard tie specifications; study and report on substitutes for wooden ties; study and report on best practice for grading marks for ties to indicate acceptance; study and report on methods and rules for tie acceptance inspection; study and report data on tie renewal averages per mile of maintained track; *study and report on best shape of cut spike point for use in prebored ties; study and report upon methods and practices for proper seasoning of ties, with particular reference to increasing their service life; study and report upon the extent, if any, to which decay is permissible in ties offered for treatment; the various forms of such decay and proper methods for detecting same.* W. J. Burton, assistant to chief engineer, M. P., St. Louis, Mo.

Rail—Study and report on details of mill practice and manufacture as they affect rail quality and rail failures, giving special attention to transverse fissure failures, collaborating with the Rail Manufacturers' Technical Committee; continue the compilation of statistics of all rail failures, making special study of transverse fissure failures; study and report on cause and prevention of rail battering, collaborating with the Committee on Track; study and report on the economic value of different sizes of rail; study and report on the inter-relation of sizes and fit of track fastenings for rails of all weights, including size and location of rail drilling, bolt punching of joint bars and spike slotting of joint bars, also size of track bolts, collaborating with the Committee on Track; study and report on revision or elimination of specifications for spring washers, collaborating with the Committee on Track; continue the compilation of information of tests of alloy and of heat-treated carbon steel rails, addressing the various railways for records of such tests as may have been made; *study and report upon the branding of tee rails, with a view toward standardization, collaborating with Committee on Track.* Earl Stimson, chief engineer maintenance, B. & O., Baltimore, Md.

Track—Prepare plans and specifications for track tools, collaborating with the Committees on Roadway, Ballast, and Economics of Railway Labor; study and report on detailed plans of switches, frogs, crossings and slip switches; study and report on track construction in paved streets, collaborating with the Committee on Grade Crossings; study and report on corrosion of rail and fastenings in tunnels, collaborating with the Committee on Rail; study and report on methods of reducing rail wear on curves, with particular reference to lubricating the rail or wheel flanges, collaborating with the Committee on Rail; continue critical review of material in former proceedings with respect to the cause and effect of brine drippings, collaborating with the Committees on Rail, Iron and Steel Structures, and the Mechanical Division, A. R. A.; *study and report on gage of track and elevation of curves in the light of use of roller bearings on railway equipment, collaborating with Mechanical Division, A. R. A.; study and report upon existing material on design of tie plates and punching thereof, together with inter-relation of slotting of joint bar and size of track spike, collaborating with the Committee on Rail.* J. V. Neubert, chief engineer maintenance of way, N. Y. C., New York City.

Buildings—Study and report on specifications for concrete used in railway buildings, collaborating with the Committee on Masonry; study and report on design and construction of water station buildings, collaborating with the Committee on Water Service and Sanitation; continue the preparation of specifications for buildings for railway purposes; *study and report on what constitutes appraisal of fire losses; study and report upon waterproofing and dampproofing as applied to building construction; collaborate with the Special Committee on Clearance in preparation of clearance diagram for recommended practice.* F. R. Judd, engineer of buildings, I. C., Chicago.

Wooden Bridges and Trestles—Study and report on simplification of grading rules and classification of timber for railway uses, collaborating with other organizations dealing with this subject; study and report on the standardization and simplification of store stock and disposition of material reaching obsolescence, collaborating with other committees and organizations concerned; *study and report on overhead wooden bridges; study and report on the economy of substituting metal inner guard rails, equipped with appropriate tie spacers, for wooden outer guard rails, and consider further the advisability of producing the guard rails to a point in the center of the track beyond the ends of the trestle to guide derailed wheels; study and report on the design of standard wooden trestles with a view of obtaining greater economy and conserving the timber resources of the country; suggest the use of 8-ft. in place of 10-ft. ties; change stringer dimensions from 7 in. by 16 in. continuous two-panel stringers to 6 in. by 18 in. one-panel type; and two-piece for one-piece caps, the lower piece to be of greater compressive strength, the upper to be of greater width to receive the stringer load.* H. Austill, bridge engineer, M. & O., St. Louis, Mo.

Masonry—Study and report on principles of design for plain and reinforced concrete for use in railway buildings, bridges and culverts, collaborating with the Committees on Roadway, Buildings, Iron and Steel Structures, Water Service and Sanitation, and Electricity; study and make annual report upon progress in the science and art of concrete manufacture; *study and report upon typical failures of masonry walls and foundations and present conclusions to be drawn therefrom;* maintain contact with the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, and report to the association; study and report on specifications for foundations, including excavation, cofferdam, piling, etc.; study and report upon general practices for waterproofing railway structures, collaborating with the Committees on Buildings and Iron and Steel Structures. C. P. Richardson, engineer track elevation, C. R. I. & P., Chicago, Ill.

Grade Crossings—Study and report on the comparative merits of various types of grade crossings protection, collaborating with the Committee on Signals and Interlocking, the Safety Section, A. R. A., and the Highway Research Board; study and report on the economic aspects of grade crossing protection versus grade separation; study and report on the use of center columns for highway grade separations; study and report on methods for developing and evaluating the relative benefits to the public and the railways from: (a) grade crossing protection, (b) elimination of grade crossings, (c) reduction of traffic on highway grade crossings; *study and report on the desirability and form for a uniform sign at railway grade crossings to notify the public that watchman, gates or other protective devices are not in service during the full-hour period; study and report on classification and form for recording and reporting highway grade crossing accidents, with a view of determining the relative extent of contributory causes, collaborating with the Safety Section, A. R. A., the Bureau of Railway Economics, and the Association of Railway Claim Agents.* F. J. Stimson, assistant chief engineer maintenance, Penna., Chicago.

Signals and Interlocking—Study and report on development of automatic train control, collaborating with the Train Control committee, A. R. A.; study and report on developments of automatic highway crossing protection, collaborating with the Committee on Grade Crossings; study and report on increased efficiency in railway operation by signal indication in lieu of train orders and time table superiorities, collaborating with the Committee on Economics of Railway Operation; prepare and submit as information a synopsis of the principal current activities of the Signal Section, A. R. A., supplemented with a list and references, by number, of adopted specifications, design and principles of signaling practice. W. M. Post, assistant chief signal engineer, Penna., Philadelphia, Pa.

Records and Accounts—Report progress on changes or revisions in I. C. C. Classification of Accounts; study and report progressively on methods and forms for gathering the necessary data for keeping up to date the physical and valuation records of the property of railways with respect to: (a) changes made necessary in government regulations, (b) simplicity and practicability of use; study and report on methods and forms for handling the Interstate Commerce Commission's requirements under Order 15100—Depreciation Charges of Steam Railway Companies; study statistical requirements of the accounting, operating or other departments with respect to maintenance-of-way and structures, and recommend reports which, as far as possible, will reduce the number required and permit uniformity, simplicity and economy; *study and report on methods and forms (a) for maintaining a record of railway, highway and private grade crossings, and (b) for making annual reports of grade crossings added or eliminated, collaborating with the Committee on Grade Crossings; collaborate with the Committee on Economics of Railway Labor in the preparation of standard forms on which data relative to labor-saving devices may be kept; collaborate with the Committee on Rules and Organization, in the design of Bridge Inspection Report Form; study and report on accounting for industry tracks in its relation to ownership and contract provisions; prepare current periodical and book reviews on subjects pertaining to the work of this committee.* J. H. Hande, accounting engineer, B. & O., Baltimore, Md.

Rules and Organization—Revision of Manual, making a study of the subject-matter of each standing committee, distinguishing where necessary between rules and specifications, abstracting therefrom such material as may be suitable for rules, collaborating with standing committees concerned therewith; study and report on rules for the guidance of employees of the main-

tenance of way department, with special reference to (a) rules for maintenance of bridges, (b) rules for maintenance of terminal structures other than buildings, (c) rules for maintenance of telegraph and telephone lines and appurtenances; study and report on engineering titles below rank of division engineer, as employed by railway, to designate positions of corresponding rank in maintenance of way service, and make recommendations that will promote uniformity in nomenclature; study and report on rules for fire prevention as applying to railway property, collaborating with the Railway Fire Protection Association. E. H. Barnhart, industrial engineer, B. & O., Baltimore, Md.

Water Service and Sanitation—Study and report upon the cause and extent of pitting and corrosion of locomotive boiler tubes and sheets, giving consideration to quality of water, character of metals, methods of manufacture and types of boiler construction, collaborating with Mechanical division, A. R. A.; study and report on relative cost of impurities in locomotive boiler water supply and value of treatment with respect to the advantages of: *(a) saturated lime solution as compared with milk of lime solution and best methods of obtaining same, (b) economical features of barium treatment for particular waters and best practices for locomotive supplies; study and report on methods of laying cast iron pipe, and prepare complete specifications, collaborating with the Committee on Roadway; study and report on various forms used by railroad water service departments, collaborating with the Committee on Records and Accounts; study and report on storage of water at water stations, including tanks, standpipes, storage and sedimentation basins and reservoirs; study and report on the zeolite treatment of water for locomotives, with limitations, if any, for this form of treatment and possibilities in combination with lime-soda treatment;* make final report on the design and maintenance of trackpans for locomotive supply; *study and report upon the chemical control and general supervision of water softening plants; study and report upon the importance of protecting boilers and boiler materials from corrosion and deterioration while in storage, collaborating with the Mechanical Division, A. R. A. and Purchases and Stores Division, A. R. A.;* study and report on progress being made by federal and state authorities on regulations pertaining to drinking water supply, collaborating with the Joint Committee on Railway Sanitation, A. R. A.; study and report upon methods and practices of securing and handling water for drinking and culinary purposes by the railroads, collaborating with the Joint Committee on Railway Sanitation, A. R. A.; study and report upon drinking water and coach yard sanitation, establishing contact with public health, medical and other bodies engaged in similar studies, collaborating with the Joint Committee on Railway Sanitation, A. R. A.; *collaborate with the Special Committee on Clearances in the preparation of clearance diagram for recommended practice.* C. R. Knowles, superintendent of water service, I. C., Chicago.

Yards and Terminals—Study and report on design of passenger terminals, with particular reference to convenience and economy of operation of coach yards, collaborating with Committees on Water Service and Sanitation, and Shops and Locomotive Terminals, and the Joint Committee on Railway Sanitation, A. R. A.; study and report on uniform form of agreement for Joint Ownership, Use and Management of a Terminal Project, giving special consideration to fundamental requirements, collaborating with the Committee on Uniform General Contract Forms; *study and report on motor bus and truck facilities, including provisions for parking and garage facilities for private automobiles of railway passengers at passenger terminals and way stations, as affecting through passenger and local freight stations, collaborating with the Committee on Economics of Railway Operation;* study and report on design and operation of freight terminals, including motor trucks, collaborating with the Motor Transport Division, A. R. A.; study and report on proper requirements for the design and construction of humps in terminal yards, collaborating with the Committee on Economics of Railway Operation; *study and report on co-ordination of facilities at rail and water terminals;* study and report on specifications for various types of scales used in railway service; *collaborate with Special Committee on Clearances in preparation of clearance diagram for recommended practice.* J. E. Armstrong, assistant chief engineer, C. P. R., Montreal, Que.

Iron and Steel Structures—Make final report on Specifications for Steel Highway Bridges; study and report upon the feasibility of electric welding of connections in steel structures; study and report on the behavior of bridge pins under test loads; *study and report on tests of I-beams in groups;* study and report on the behavior of steel columns under test loads; study and report on the desirability of using copper-bearing steel for structural purposes; study and report on the influence of dead load upon impact from moving loads on bridges; make final report on bearing values of large rollers; study and report on Specifications for Punched and Reamed Work; *study and report on longitudinal forces as they apply to railway bridge superstructures and substructures; study and report on design for rivet heads for steel structures; collaborate with Special Committee on Clearances in preparation of clearance diagram for recommended practice.* A. R. Wilson, engineer of bridges, Penna., Philadelphia, Pa.

Economics of Railway Location—Study and report on economics of grade revision as affected by the introduction of electric locomotives, collaborating with the Committee on Electricity; study and report on the relative merits of ruling grades lighter than 0.4 per cent, in the light of modern operating requirements; study and report on the relative merits of increasing tonnage by the reduction of ruling grades or by the introduction of locomotives with greater tractive power, with consideration of momentum grades and the development of the locomotive booster; prepare in form for convenient use, essential operating data required for making relative comparisons of values for studies of line and grade revisions to meet modern operating requirements; study and report on the extent train resistance is increased when trains are operating on flexible rails as compared with same operation with stiffer rails, collaborating with the Committees on Rail, and Economics of Railway Operation; *study and report on the proper size and character of field organizations for railway location and construction.* F. R. Layng, assistant chief engineer, B. & L. E., Greenville, Pa.

Wood Preservation—Study and report on definitions used in wood preservation; study and report on service test records for treated ties; study and report on piling used for marine construction; study and report on effect of preservative treatment by the use of: (a) creosote and petroleum, (b) zinc chloride and petroleum; study and report on Specifications for Treatment of Air Seasoned Douglas Fir; *study and report on destruction by termite and possible ways of preventing it; study and report on loss of preservative in treated ties in track due to repeated use of oil-burning weed destroyers, collaborating with the Committee on Roadway; study and report on preservative treatments best adapted to make tropical grown timber available for use in temperate zones.* F. C. Shepherd, consulting engineer, B. & M., Boston, Mass.

Electricity—Continue study of the subject of inductive co-ordination, as well as representation on the American Committee on Inductive Co-ordination or other similar joint committees as may be desirable; study and report further on water power developments on Passamaquoddy bay, the St. Lawrence river, and the Tennessee river; also study and report on any other water power development projects as well as collect and submit any additional information which may become available with regard to the application of water power to railway electric operation; continue study of electrolysis and co-ordination and representation on the American Committee on Electrolysis; continue collaboration with the American Standards Association and the U. S. Bureau of Standards in the revision of the National Electrical Safety Code and other codes of similar character; continue negotiations with the National Electric Light Association on study of electric light, power supply and trolley lines crossing railways, co-operating with other sections of the American Railway Association. Continue state representatives and their alternates; revise and keep up to date the Transmission Line and Catenary specifications; collaborate with the Committee on Economics of Railway Location, on the study of economics of grade revision as affected by the introduction of electric locomotives; study and report on insulating tapes; study insulators, with a view of keeping up to date the specifications previously adopted; *collect data on clearances for third-rail and overhead construction from the various railways now electrified and report them as of November 1, 1929; collaborate with the Special Committee on Clearances in the preparation of clearance diagram for recommended practice;* study and report on protection of oil sidings from danger due to stray currents with a view to keeping up to date rules previously adopted, and including static electricity if found desirable; study and report on track and third-rail bonds, co-operating with other technical organizations interested, with especial reference to: (a) study of details of bond design with a view to developing specifications covering the different classes of bonds, (b) collection of data on compositions used on rails and rail joints to replace bonds, (c) study of contact areas and resistances for different types of bonds; keep up to date the incandescent lamp schedules; develop specifications for incandescent lamps; and continue the study of flood lighting for classification yards and for other railway purposes, collaborating with the Committee on Yards

and Terminals; study and report on design of indoor and outdoor substations; study and report on cables for carrying high voltages; study and report on application of corrosion-resisting materials to railway electrical construction. Sidney Withington, electrical engineer, N. Y. N. H. & H., New Haven, Conn.

Uniform General Contract Forms—Continue study and report on cost-plus, percentage and fixed-fee methods in construction contracts; study form of agreement for the purchase of electrical energy in large volume (such as required for traction purposes), collaborating with the Committee on Electricity; study form of agreement for wire-line crossings, collaborating with the Committee on Electricity; study form of agreement for the organization and operation of a joint passenger terminal project, collaborating with the Committee on Yards and Terminals; study of form of application for industry track. J. C. Irwin, valuation engineer, B. & A., Boston, Mass.

Economics of Railway Operation—Study and report on methods for obtaining a more intensive use of existing railway facilities, with particular reference to increasing carrying capacity: (a) without material additional capital expenditures, (b) with due regard to reasonable increase in capital expenditures consistent with traffic requirements; study and report on methods or formulas for the solution of special problems relating to more economical and efficient railway operation; study and report on the most economical makeup of track to carry various traffic densities, collaborating with the Committees on Roadway, Ballast, Ties, Rail, and Track; study and report on suitable units for operating and equipment statistics required by Interstate Commerce Commission to be used in cost comparisons of transportation, equipment and roadway maintenance, with necessary additions thereto, collaborating with the Committees on Records and Accounts, and Economics of Railway Labor; study and report on what volume or other conditions of business or service justify a change from flat switching to the hump method in any given yard, collaborating with the Committee on Yards and Terminals; study and report on problems of railway operation as affected by the introduction of motor trucks and bus lines, with particular reference to its effect upon branch or feeder lines, collaborating with the Committee on Yards and Terminals, and with the Motor Transport Division, A. R. A.; study and report on methods for determining the most economical train length, considering all factors entering into transportation costs, such as fuel, road time, length of passing sidings, per diem, etc; *study and report on economies resulting from use of radio telephones for long freight trains and for yard work.* J. E. Teal, special engineer-operation, C. & O., Richmond, Va.

Economics of Railway Labor—Study and report on standardization of parts and accessories for railway maintenance motor cars; study and report on best means for practical training and education of the individual workman in his assigned duties, as a means for securing an increased output of better work, with less effort and fewer accidents; *analyze and report on the operations of railways that have made marked progress in the reduction of labor required in maintenance of way; study and report on the best methods of cost-keeping data for maintenance of way operations; study and report on a plan for using college and university students as apprentices in engineering and maintenance work, collaborating with the Committee on Co-operative Relations with Universities; study and report on methods and practices for training field employees in the engineering and maintenance departments for the proper reporting of essential data required for accounting and original records, collaborating with the Committees on Records and Accounts, and Rules and Organization; study and report on standardizing of voltage, kind of current, etc., for use in electrically operated machines and tools for roadway purposes; study and report on various forms of snow-melting devices as an aid in facilitating train operation and reducing costs of maintenance, collaborating with the Committee on Roadway, and the Committee on Track.* A. N. Reece, chief engineer, K. C. S., Kansas City, Mo.

Committee on Shops and Locomotive Terminals—Study and report on ashpits; study and report on general layouts and designs of car shops, collaborating with appropriate committee of the Mechanical division A. R. A.; study and report on enginehouses, collaborating with appropriate committee of Mechanical division, A. R. A.; study and report on general layouts and designs of typical locomotive repair shops, collaborating with appropriate committee of Mechanical division, A. R. A.; *study and report on adapting the general layouts and design of car shops for inspecting and repairing multiple unit electric cars, collaborating with appropriate committee of Mechanical division, A. R. A.; study and report on adapting the design of engine houses and the general layouts and design of typical locomotive repair shops for the inspection and repair of electric locomotives, collaborating with the appropriate committee of Mechanical division, A. R. A.* A. T. Hawk, engineer of buildings, C. R. I. & P., Chicago.

Co-operative Relations with Universities—Robert H. Ford, assistant chief engineer, C. R. I. & P., Chicago.

Special Committee on Stresses in Railroad Track—Continue the study of stresses in railroad track. A. N. Talbot, professor emeritus, U. of Ill., Urbana, Ill.

Special Committee on Clearances—Prepare a clearance diagram for recommended practice by which the operation of trains would be affected, with statement attached as to whether the diagram conforms or conflicts with existing state laws, collaborating with the committees on roadway, track, buildings, wooden bridges and trestles, masonry, signals and interlocking, water service and sanitation, yards and terminals, iron and steel structures, electricity and also with the proper committees of the Mechanical and Operating divisions, A. R. A. A. R. Wilson, Iron and Steel Structures.

Special Committee on Rivers and Harbors—Submit definitions of terms pertinent to river and harbor construction, protection and maintenance; study and report on methods for providing against river bank erosion; determine the best types of construction for levees and river dikes for flood protection, *giving consideration to stream alinement, sub-surface, soil or other local conditions; prepare specifications covering the several types of river protection work in common use;* determine the proper allowance for swell in scow measurement dredge work; determine the proper amount of allowable overdepth in dredging to obtain the required operating depth; study and report on the silt deposit in fresh water rivers and in brackish waters, also studying the effect of slight salinity on such deposit; prescribe the best approved methods of taking soundings in river waters and in tidal waters with both hard and soft bottoms; ascertain the usual slopes taken in deep waterways for quiet waters and those affected by wave action; *study and report the results of deepening channels on the salinity in rivers and estuaries; study and report on the various types of dredges and indicate their respective uses; prepare specifications for dredging.* Col. Wm. G. Atwood, consulting engineer, New York City.

Special Committee on Standardization—W. C. Cushing, engineer of standards, Penna., Philadelphia, Pa.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 15-17, 1929, New Orleans, La.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 28-30, 1930, Seattle, Wash.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April 23-25, 1929, Arlington Hotel, Hot Springs, Ark.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 17-19, 1929, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

A Caterpillar Tractor Transporting Ties Loaded on the Bucket and Bucket Arms

RAILWAY NEWS BRIEFLY TOLD

The Boston & Maine, having completed its program of strengthening bridges on its line between Mechanicville, N. Y., and Portland, Me., now operates its largest locomotives, the "4000 Lima" type, through between these cities, a distance of 270 miles, hauling 100-car freight trains.

The Department of Public Utilities of Massachusetts, in its annual report, recommended the adoption of a more vigorous policy in eliminating highway grade crossings in that state. The department believes that the state should pay a larger proportion of the cost of the work than is now done in most cases.

The New York Central is considering the electrification of its line between New York and Buffalo, a distance of nearly 500 miles. Officers of the road have stated that no conclusions have yet been reached as there are a number of questions to be considered in the project which, it is estimated, would cost approximately $75,000,000.

Franklin D. Roosevelt, the new governor of the State of New York, in his first message to the legislature, called attention to the importance of eliminating grade crossings of railways and highways and said that he was not satisfied with the governmental machinery for dealing with this problem, or with the attitude of some of the railways in regard to the matter.

The Public Utilities Commission of Colorado has refused approval of the application of the Public Service Company of Colorado for authority to construct a hydro-electric power plant in the Royal Gorge of the Arkansas river near Canon City, Colo., which was opposed by the Denver & Rio Grande Western. The commission based its action on the ground that the damage to the scenic features of the gorge by reason of the construction of the plant would far outweigh any economic factors which might accrue from lower rates for electric power, especially since it was not shown by the power company that the rates would be reduced.

The Pennsylvania is installing a large door at the west end of a tunnel at Caledonia, Pa., on what is known as the Low Grade branch, for the purpose of preventing the formation of ice in the tunnel and thereby eliminating the necessity of keeping the track gangs employed during the winter months to remove the accumulation which would otherwise encroach upon the clearance lines. On this branch, which was the Allegheny valley when it was acquired by the Pennsylvania in 1900, doors were formerly maintained at this tunnel as well as at one at Sabula, but the practice was discontinued after the change of ownership was effected. A large stove will also be installed to assist in heating the tunnel.

Revenue freight car loadings for 1929 have started off with an increase over the same period last year, the total for the week ending January 5 having amounted to 798,723 as compared with 754,247 in the corresponding week in 1928, an increase of 44,476 cars. In the week ending January 19, the latest for which information is available, the total was 931,880 as compared with 884,683 during the corresponding week last year. The cumulative total for the first three weeks of 1929 was 2,644,790, as compared with 2,544,891 and 2,812,781 in the corresponding period in 1928 and 1927 respectively. The total loadings for 1928 amounted to 51,576,731 cars, a decrease of 59,075 or 0.1 per cent, as compared with the total for 1927, and a decrease of 1,522,088, or 2.9 per cent, as compared with 1926.

Typewriters operated over telephone wires have been introduced by the American Telephone & Telegraph Company for use where prompt communication is essential and it is also desirable to have typewritten copies of the messages at both the sending and receiving stations, as when instructions are issued or orders for materials are transmitted. The typewriters used are similar to the ordinary machine and can be operated by any typist. The printing can be done on standard-sized letter sheets or on a narrow strip, as preferred, at the rate of about sixty words a minute. The A. T. & T. Company now has approximately eighty thousand miles of wire in service for this purpose, of which about forty-seven thousand miles were installed during the last year.

The program of the opening ceremonies of the Great Northern's new Cascade tunnel in the State of Washington was broadcast on January 12 over 38 radio stations of the National Broadcasting Company, reaching listeners in all parts of the country. President-elect Hoover, the principal speaker, delivered his speech from the library of his home in Washington, D. C., several thousand miles away from the actual scene of the dedication. Other speakers were Ralph Budd, president of the Great Northern, who spoke from the east portal just before the first train started through the tunnel, and again after it emerged from the west portal; W. W. Atterbury, president of the Pennsylvania, who spoke from his suite in the Bellevue-Stratford hotel in Philadelphia, Pa., and J. B. Campbell, former chairman of the Interstate Commerce Commission, who spoke from the studio of the National Broadcasting Company at Washington, D. C. In addition, Mme. Ernestine Schumann-Heink sang a number of songs from San Francisco, Cal., and George Oleson's orchestra played several selection in the New York studio of the broadcasting company. This was the first of 23 weekly programs sponsored by the Great Northern which are to be broadcast over the same chain.

L. G. Bentley, chairman of the Committee on Education of the Safety section, A. R. A., devoted his circular for February to an argument to demonstrate the value and practicability of safety contests between different departments or between different territorial sections of departments, basing his recommendations on the carefully recorded results of successful contests which have already been carried out on American railways. Among the conditions which should govern such contests, Mr. Bentley suggests the following: They should be inaugurated by a mandate of the president of the road to insure full official support and the loyal co-operation of the employees; they should run for a year and become a permanent institution; they should be fair and to this end there should be different contests for the various departments; all lost-time injuries should be investigated promptly, recorded properly and reported correctly; printed bulletins, prepared in clear, concise form, should be posted promptly at the close of each month to show the standing of the contestants and the cumulative results to date, and suitable trophies should be awarded the winning departments. The reasons for safety contests are summarized as follows:

1. They demand fact finding and placing responsibility for accidents.
2. They bring out the best there is in an organization.
3. They disclose those units which are not functioning properly and encourage those which are making good.
4. They link more closely the vital interests of employer and employee.
5. They are in a righteous cause.
6. They save lives.

Construction News

The Algoma Central & Hudson Bay closed bids on January 21 for the construction of a concrete and steel coal dock and bridge at Michipicoten, Ont., which it is estimated will require the expenditure of about $450,000.

The Atchison, Topeka & Santa Fe has awarded a contract to the List & Bagwell Construction Company, Kansas City, Mo., for the construction of three miles of new main line at Topeka, Kan. The cut-off will effect a reduction in grades and the elimination of a number of street grade crossings. The construction of 12 miles of second main track between Burrton, Kan., and Hutchinson has been authorized and it is also planned to construct three miles of second main track through the yard and make other improvements in trackage facilities at Waynoka, Okla.

The Baltimore & Ohio has been authorized by the Interstate Commerce Commission to extend for two miles its Marley Neck branch in Baltimore and Ann Arundel county, Md., at an estimated cost, including land of $1,530,000.

The Canadian Pacific has let a contract for the remodelling of 109 guest rooms at the Empress Hotel, Victoria, B. C., to David W. Burnett, Victoria, at a cost of about $115,000 and plans to call for tenders immediately for the construction of an addition to the hotel which will contain 270 guest rooms with baths. The entire cost of the addition is estimated at $2,500,000.

Plans have been announced for a program for the construction of about 1,200 miles of branch lines which will be submitted to the Canadian Parliament for approval.

The Chicago, Rock Island & Pacific plans the expenditure of approximately $25,000,000 during 1929 for new construction on its lines. It is expected that the construction of 146 miles of extensions, including 85 miles between Trenton, Mo., and Birmingham, and 61 miles between Gruver, Tex., and Liberal, Kan., will cost about $6,760,000. Passenger platform canopies at Des Moines, Iowa, and a new freight station at Ottawa, Ill., will be constructed. Yard and terminal layouts will be improved at Blue Island, Ill., Armourdale, Kan., Pratt and Liberal and El Reno, Okla., at a total cost of $1,000,000. A new steel car repair shop will be constructed at El Reno to cost $370,000 and a freight terminal will be constructed at Omaha, Neb., at a cost of $240,000. About $250,000 will be spent for a continuation of the grade revision program on the Illinois division and about $400,000 will be spent for grade revision between Norwalk, Tex., and Perkins to accommodate a drainage district which has been established in Dallas county, Tex. The flood protection program for 1929 includes the improvement of the line along the White river in Arkansas and on the St. Louis-Kansas City division. Other major items of construction and their approximate cost include: Fire protection at 25 points, $100,000; work in connection with the straightening of the Chicago river at Chicago, $720,000; track elevation at Chicago, $168,000; water stations, $400,000.

The Colorado & Southern has let a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 150-ton capacity, three-track automatic electric reinforced concrete coaling station at Walsenburg, Colo.

The Delaware, Lackawanna & Western has awarded a contract to the Turner Construction Company, Buffalo, N. Y., for the rebuilding of its docks and lake freight house at Buffalo, N. Y. A contract also has been given to Foley Brothers, Inc., New York, for the construction of a new pier at its Jersey City, N. J., terminal, as well as one for the construction of a new pier north of Pier 9, North River, New York. The new structure, to be known as Pier 10, will be 1,200 ft. in length and 42 ft. wide.

The Grand Trunk Western has reached an agreement with the Eastern Michigan (electric) and the city of Pontiac, Mich., which will enable it to proceed with the construction of its belt line around that city.

The Louisville & Nashville has authorized the construction of a 10-story office building at Louisville, Ky., which will adjoin the present building at Tenth street and Broadway in that city. This project will involve an expenditure of about $750,000.

The Missouri Pacific has let a contract to A. Guthrie & Co., St. Paul, Minn., for the construction of 15 miles of second main track south of Newport, Ark.

Additional expenditures totaling $2,096,000 have been authorized for the protection of lines in Arkansas against damage by high water. This appropriation will be used for raising the grade above high water between Newport and Bradford, 16 miles, and for applying stone ballast and riprap in the White and Cache river valleys between Bald Knob and Wynne and between McCrory and New Augusta, 9 miles. When this work is completed the total expenditure for flood protection since 1927 will be $5,025,000 of which $3,221,000 will have been spent in Arkansas.

The construction of a five-stall addition to the roundhouse at Poplar Bluff, Mo., is planned. With other terminal improvements the expenditure at this point is expected to approximate $100,000. Plans have also been announced for the construction of coach repair facilities at a cost of $175,000 at Kingston, Tex., to replace those recently destroyed by fire.

The City of St. Louis, Mo., has opened negotiations with the Missouri Pacific and the St. Louis-San Francisco relative to a division of costs of the construction of the proposed $408,000 viaduct which will carry Hampton avenue over the two railroads and the River Des Peres. The viaduct will be 1,200 ft. long and 60 ft. wide.

The New Jersey, Indiana & Illinois has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of an electric direct locomotive coaling station at South Bend, Ind.

The New York Central has reached an agreement with the city of New York which provides for the electrification of that road's freight lines on Manhattan Island and the elimination of all grade crossings between Spring street and the Harlem ship canal. Enlargement of the yard and terminal facilities will also be made.

The New York, New Haven & Hartford has awarded a contract to the Long Construction Company, Boston, Mass., for building the superstructure for an addition to its freight house at Fargo street in Boston. The addition will be 648 ft. long and 60 ft. in width, and will cost approximately $100,000. A contract also has been given to the Canter Construction Company, Inc., Boston, Mass., for work on additions, alterations, etc., to the present brick freight house at Roxbury, Mass., to provide a storage building, and for the construction of an automobile unloading platform 460 ft. in length. The total cost of the project will amount to about $90,000.

The New Orleans Public Belt has applied to the Interstate Commerce Commission for authority to extend its line by erecting a bridge across the Mississippi river immediately above the city of New Orleans, together with approaches, including about 4.2 miles of tracks.

The Pennsylvania has awarded a contract to the Fritz-Rumer-Cooke Company, Columbus, O., for the construction of concrete bridges with retaining walls on its line at Columbus, O. The project will cost approximately $560,000.

The contracts between this road, the Public Service Corporation and the United New Jersey Railroad & Canal Company in regard to the new station to be erected by the Pennsylvania at Newark, N. J., have been signed and work on the project will begin within three months. It is estimated that the cost to the railroad will be about $12,500,000 and that the city will expend a similar amount in connection with the work.

A contract has been awarded to the Ogle Construction Company, Chicago, for the construction of a 500-ton four-track reinforced concrete electric coaling station and sand handling plant, and a reinforced concrete ash pit at South Philadelphia, Pa.; a 50-ton two-track electric steel coaling station and a single-track ash handling plant at Lewistown, Pa.; and for a single-track automatic direct coaler and single-

track ash handling plant at Phillipston, Pa.

The Pittsburgh & West Virginia has awarded a contract to the Vang Construction Company, Cumberland, Md., for the construction of 10 miles of new track from Cochran's Mill, Pa., to Monongahela, Pa., at a cost of about $1,000,000. This is the first section of the proposed extension of this road from Cochran's Mill, Pa., to Connelsville, Pa., a distance of 38 miles.

The Reading plans construction and improvements which will involve an expenditure of approximately $35,000,000 during 1929. The largest sum to be spent will be for the electrification of the road in the metropolitan district of Philadelphia, for which the directors have appropriated $20,000,000. Work on this project is to be started in the spring.

Other projects which will be included in expenditures for improvement will include the completion of the North Broad Street station, Philadelphia, at a cost of more than $2,000,000; a new commercial building to be erected on North Broad street, Philadelphia, for office and warehouse facilities, at a cost of approximately $4,000,000; a new bridge over the Susquehanna river at Muncy, Pa., to cost about $1,500,000; a passenger station at Pottstown; the erection of a new storehouse and other buildings at the Reading car shops, costing approximately $1,000,000; improvements to the station at Harrisburg, Pa.; erection of coal yard facilities at Atlantic City, N. J., and a new water supply at Abrams, Pa.; extensions and changes to the freight house and the construction of two new coal yards in Philadelphia.

An extensive campaign for the elimination of grade crossings on the Reading lines also will be included in the expenditures for the year, one of the largest of which will be grade crossing eliminations through Manayunk, Pa.

The South Plains & Santa Fe has applied to the Interstate Commerce Commission for a certificate for the construction of a branch line from a point near the Texas-New Mexico state line to Lovington, N. M., 20.5 miles.

The St. Louis Electric Terminal, with its lessee, the Illinois Terminal, has been authorized by the Interstate Commerce Commission to construct a 2.6-mile extension from the west end of the McKinley bridge, St. Louis, at an estimated cost of $4,972,950.

The Southern Pacific will close bids on February 16 for the construction of the superstructure and foundation of the proposed bridge over Suisun bay between Martinez, Cal., and Army Point.

The Texas City Terminal has awarded a contract for the construction of a two-story reinforced concrete warehouse, 120 ft. by 1,160 ft., at Texas City, Tex., to C. R. Berry & Co., Houston, Tex. The total cost of the structure will be about $400,000.

Supply Trade News

General

The Truscon Steel Company, Youngstown, Ohio, has moved its railroad division from Chicago to the home office at Youngstown.

The Duff Manufacturing Company, Pittsburgh, Pa., has purchased A. O. Norton, Inc., Moline, Ill. The new company will be known as the Duff-Norton Manufacturing Company.

The Fairbanks, Morse Water Supply Company, Chicago, has been organized by Fairbanks, Morse & Co. to provide water supplies for railroads, industries and municipalities. The new company will make investigations of water sources and will agree to deliver definite quantities and qualities of water at definite prices through facilities which it will install at its own expense, with the provision that these facilities shall become the property of the railroad without further charge after a period of years.

The Milburn Sales Corporation and the **Milburn Paint Spray Corporation** have been organized to carry on the sales of a number of the products manufactured by the Alexander Milburn Company, Baltimore, Md. **Alexander F. Jenkins** is president and treasurer, and Edward P. Boyer is vice-president of both of the newly-organized companies. **Louis J. Herzog** is secretary of the Milburn Sales Corporation and **Robert M. Zimmermann** is secretary of the Milburn Paint Spray Corporation.

Personal

N. J. Ocksreider, 9 South Clinton street, Chicago, has been appointed district sales manager for the Chicago territory for the Syntron Company, Pittsburgh, Pa.

Judd Spray, sales manager of the Timken Roller Bearing Company, Canton, Ohio, with headquarters at Canton, has been promoted to vice-president and general sales manager, with headquarters at the same point.

J. E. Murray, formerly eastern and export sales manager for the Buda Company and later for the Kalamazoo Railway Supply Company, has opened an office as manufacturer's agent at 50 Church Street, New York, where he will engage in the handling of both domestic and export business.

J. E. O'Leary, sales manager of the New York office of the Pittsburgh-Des Moines Steel Company since 1914, has been promoted to general sales manager with headquarters at Pittsburgh, Pa. **H. W. Ford** succeeds Mr. O'Leary as manager of the New York office and **G. A. Smith** will direct the construction and erection activities of the company. **W. E. R. Moore,** formerly with the American Locomotive Company, has been appointed export manager with headquarters at the New York office.

William Bager, vice-president in charge of engineering and manufacturing for the Bucyrus-Erie Company, South Milwaukee, Wis., has also been placed in charge of domestic sales. **J. G. Miller,** assistant to the senior vice-president, has been promoted to manager of domestic sales, and four assistant sales managers have been appointed as follows: **P. H. Birckhead,** formerly in charge of sales of large units; **J. A. Garber,** formerly in charge of sales of small units; **M. F. Keise,** formerly commercial engineer in charge of dredges, and **M. J. Woodhull,** formerly district manager of the central sales office.

C. E. Tebby, assistant general superintendent of treating plants of the T. J. Moss Tie Company, St. Louis, Mo., has been promoted to general superintendent of treating plants to succeed **John S. Penney,** whose advancement to vice-president was noted in the January issue. Mr. Tebby, who was an inspector of forest products on the Baltimore & Ohio for 11 years, entered the service of the T. J. Moss Company in 1920 as superintendent of its East St. Louis (Ill.) treating plant. He was promoted to assistant general superintendent of treating plants in 1923, which position he was holding at the time of his recent promotion to general superintendent of treating plants.

Carl S. Clingman, assistant district sales manager of the St. Louis district of the Johns Manville Corporation, has been promoted to assistant general sales manager of the railroad and government department, with headquarters at New York. **Elliott Fairback** has been appointed special representative in the St. Louis district to take the place of **D. B. Bell,** who has been transferred to Houston, Tex., to succeed **A. C. Pickett,** who, in turn, has been transferred to the St. Louis district to succeed Mr. Clingman.

Carl S. Clingman

Mr. Clingman was educated at Northwestern University and in 1904 entered the apprentice school of the

Pullman Company. He was promoted to assistant general shop foreman at the Pullman works in Chicago in 1907, and in the following year was promoted to eastern mechanical inspector at Wilmington, Del. He returned to Chicago in 1910 as a mechanical inspector at the Pullman works, and in 1911 was promoted to general mechanical inspector, with headquarters at Chicago. Mr. Clingman entered the service of the Johns-Manville Corporation in 1917 as sales engineer in the Southwest and in 1927 was promoted to assistant district sales manager at St. Louis, Mo., which position he was holding at the time of his promotion to assistant general sales manager on January 1.

Arthur Harvey, district engineer on the Missouri-Kansas-Texas with headquarters at Muskogee, Okla., has joined the sales department of the American Hoist & Derrick Company, St. Paul, Minn., with headquarters at the Chicago offices of that company.

F. W. Anderson, vice-president and general manager of the Northwestern Motor Company, Eau Claire, Wis., has been elected president and general manager to succeed, as president, **R. R. Rosholt**, who has been elected chairman of the board. Mr. Anderson was born at Eau Claire on October 9, 1890, and, after serving a four-year apprenticeship as a machinist with the Northwestern Steel & Iron Works at Eau

F. W. Anderson

Claire, was employed as a machinist in the shops of the Atchison, Topeka & Santa Fe at Topeka, Kan. In 1911 he entered the employ of the Northwestern Motor Company as a draftsman, later being promoted successively to shop foreman, engineer and general superintendent. During 1919 he was efficiency engineer for the Ingersoll Milling Machine Company at Rockford, Ill., and in October, 1920, he was elected vice-president and general manager of the Northwestern Motor Company, which position he held until his recent election as president.

P. D. Bowler, who has been elected vice-president and general manager of the newly-organized Fairbanks, Morse Water Supply Company, with headquarters at Chicago, was born on November 16, 1872, at Flora, Ill. He entered business in 1893 with the Branch-Crookes Saw & Machinery Company, St. Louis, Mo., and in 1897 became manager of the machinery de-

P. D. Bowler

partment of the Kieth-Simmons Company, Nashville, Tenn. Later he was appointed manager of the oil-field pumping and drilling machinery of the Peden Iron & Steel Company of Houston, Tex. In 1896, Mr. Bowler and M. E. Layne formed a partnership under the firm name of Layne & Bowler, which later was incorporated as the Layne & Bowler Company, with Mr. Bowler as vice-president and sales manager. In 1910, he organized the Layne & Bowler Corporation, of which he was elected president and general manager. Several years later he sold his interest in this concern to Mr. Layne and entered the contracting business in connection with the drilling of oil wells and the development of oil production.

Arthur E. Blackwood, first vice-president of the Sullivan Machinery Company, Chicago, has been elected president to succeed **Frederick K. Copeland**, notice of whose death was published in the December issue. Mr. Blackwood was educated at Toronto University and entered the service of the Sullivan Machinery Company in 1899, shortly after completing his college course, later being promoted to manager of the eastern sales department, with headquarters at New York. In 1922, he was elected first vice-president in charge of finances, with headquarters at Chicago, which position he was holding at the time of his advancement to president.

Trade Publications

Concrete Breakers.—The Sullivan Machinery Company, Chicago, has issued Bulletin 81-V, of eight pages, describing its type K-2 Concrete Buster, in which the details of construction are given, with illustrations showing the tool in use for various operations.

Sullivan "Rotator" Rock Drills.—A 32-page booklet, Bulletin 81-S, issued by the Sullivan Machinery Company, Chicago, describes four of the Sullivan "Rotator" rock drills which are designated as L-7, L-8, DP-321 and DP-331, for use in construction work where rock is to be excavated under ordinary conditions.

Copper-Bearing Steel Buildings.—The Blaw-Knox Company, Pittsburgh, Pa., has issued an attractive 37-page catalogue, No. 1057, which describes and illustrates the many types of standard steel buildings manufactured by that company, and the use being made of these buildings in a large number of industries.

American Supply Train Crane.—A folder with the foregoing title has been issued by the American Hoist & Derrick Company, St. Paul, Minn., describing and illustrating the gasoline crane with a lifting magnet which it has developed for operation on a flat car for loading or unloading materials in connection with supply train service.

Dreadnaught Buckets.—The Blaw-Knox Company, Pittsburgh, Pa., has issued a 25 page catalogue which gives a well-illustrated description of the various types of "Dreadnaught" buckets which it manufactures for various classes of work. The catalogue also contains a ready-reference chart, with summarized information concerning all of its buckets of this type.

Growing New Forests.—The St. Paul & Tacoma Lumber Company, Tacoma, Wash., has issued an informative and attractively illustrated booklet, which deals, in the main, with the reforestation program of that company in connection with its timber lands of Douglas fir in the northwest. The booklet also contains many factors of general interest to the wood-consuming interests of the country in connection with the general subject of reforestation.

Lumber.—The National Lumber Manufacturers' Association, Washington, D. C., has issued the second edition of the National Lumber Handbook, a 19-page booklet, which lists the most important publications available containing information of interest to the users of lumber. The handbook also contains a list of the more important associations and governmental agencies which maintain information service on lumber, and gives a brief description of their activities.

The Economies of Culverts.—In a bulletin of 24 pages, issued by the Armco Culvert Manufacturers Association, there is presented an analysis of the various considerations which must be taken into account in selecting the type of culvert construction best suited to any given site, from the standpoint of its ultimate economy. Among the factors discussed are: The purchase price, transportation to the site, excavation, installation, maintenance and depreciation.

Personal Mention

General

James Buckelew, superintendent of the Maryland division of the Pennsylvania, with headquarters at Wilmington, Del., and an engineer by education and experience, has been promoted to general superintendent of telegraph of the system with headquarters at Philadelphia, Pa. Mr. Buckelew was born on October 7, 1864, at Jamesburg, N. J., and was educated at Princeton University. He entered railway service on July 18, 1885, as a rodman on the Pennsylvania, serving in this position and as assistant supervisor and supervisor until January, 1900, when he was promoted to division engineer of the Renovo division, later serving in the same capacity on the Tyrone and Pittsburgh divisions. Three years later he was promoted to engineer maintenance of way of the Philadelphia, Baltimore & Washington (now a part of the Southern grand division of the Eastern region). Mr. Buckelew entered the operating department in June, 1906, as superintendent of the Central division at Media, Pa. He was transferred successively to Pittsburgh, Pa., Camden, N. J., and Wilmington, Del., and was superintendent of the Maryland division, with headquarters at the last-named point at the time of his promotion to general superintendent of telegraph of the system on January 1.

Engineering

C. D. Turley, supervisor on the Chicago terminals of the Illinois Central, has been appointed assistant engineer in the office of the engineer maintenance of way at Chicago.

L. J. Hughes, special engineer on the Chicago, Rock Island & Pacific, with headquarters at Chicago, has been promoted to engineer maintenance of way with headquarters at the same point, to succeed **J. G. Bloom,** who has retired after 26 years' service with that road.

George K. Farner, assistant engineer on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to division engineer at Beloit, Wis., succeeding **W. H. Blanchard,** who has been transferred to Green Bay, Wis., to succeed **Peter Jenney,** who has resigned to engage in other business. **R. A. Whiteford,** assistant engineer at Minneapolis, Minn., has been promoted to division engineer at the same point, succeeding **N. F. Podas,** who has been promoted to office engineer on special assignment at Minneapolis.

S. H. Kuhn, supervisor on the Panhandle division of the Pennsylvania, with headquarters at Burgettstown, Pa., has been promoted to assistant to the engineer maintenance of way of the Lake division, with headquarters at Cleveland, Ohio, to succeed **J. S. Albright,** who has been promoted to division engineer in the office of the general manager of the Central region at Pittsburgh, Pa. **J. W. Quick,** assistant on engineer corps on the Cincinnati division, has been promoted to assistant to the division engineer of the Ft. Wayne division at Ft. Wayne, Ind., succeeding **E. H. May,** whose promotion to assistant engineer in the office of the chief engineer maintenance of way of the Western region at Chicago was noted in the January issue.

William D. Supplee, whose promotion to division engineer of the Logansport division of the Pennsylvania was noted in the January issue, was born on October 1, 1892, at Philadelphia, Pa., and was educated at the University of Pennsylvania. He entered railway service on October 3, 1915, as a chainman on the Pennsylvania at Philadelphia and later served as a rodman at Harrisburg, Pa., and Altoona until August 17, when he was furloughed for military service. On his return to the Pennsylvania in April, 1919, he was promoted to assistant supervisor at Cresson, Pa., and subsequently was transferred to Jamesburg, N. J., and Paoli, Pa. In April, 1926, he was promoted to supervisor at Dunkirk, N. Y., and later served in the same capacity at Wooster, Ohio, Washington, D. C., and New York. Mr. Supplee was supervisor on the New York division, with headquarters at New York at the time of his recent promotion to division engineer.

H. J. Burlingame, maintenance inspector on the Jefferson division of the Erie, with headquarters at Susquehanna, Pa., has been promoted to assistant division engineer of the Susquehanna and Tioga divisions, with headquarters at Hornell, N. Y., succeeding **R. T. Davis,** who has been promoted to division engineer of the Delaware and Jefferson divisions, at Susquehanna, Pa., to succeed **C. M. Lewis,** who has been transferred to the Alleghany and Bradford divisions, with headquarters at Salamanca, N. Y., to take the place of **J. G. June,** whose death is noted elsewhere in these columns. **R. L. Dyke,** division engineer of the Susquehanna and Tioga divisions, with headquarters at Hornell, has been transferred to the Buffalo and Rochester divisions, with headquarters at Buffalo, N. Y., succeeding **G. W. Graves,** who, in turn, has taken Mr. Dyke's place as division engineer of the Susquehanna and Tioga divisions at Hornell.

Arthur C. Bradley, whose promotion to engineer maintenance of way of the First district of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, was noted in the January issue, was born on December 13, 1880, at Brooklyn, N. Y., and graduated from the University of Kansas in 1902. He entered railway service in January, 1903, as a rodman on the Atchison, Topeka & Santa Fe, serving in various positions up to assistant engineer on preliminary and location surveys, construction and maintenance until March, 1911, when he became an assistant engineer on the St. Louis-San Francisco. In June, 1911, he became an assistant engineer on the Rock Island at Davenport, being promoted in February, 1912, to office engineer in the office of the engineer maintenance of way of the First district at Davenport. In March, 1913, Mr. Bradley was promoted to roadmaster on the East Iowa division with headquarters at Iowa City, Iowa, and in October, 1914, he was further promoted to division engineer of the Oklahoma division with headquarters at El Reno, Okla. During the World War he was a captain in the 312th Engineers and later in the 512th Engineers, serving 15 months in France on the construction of the Nevers cut-off, during which time he was acting battalion commander for about a year. On his return to the Rock Island after leaving military service in 1920, he was appointed division engineer of the Colorado division at Colorado Springs, Colo., being transferred successively to the Chicago Terminal, the Nebraska-Colorado, the Missouri and the Illinois divisions. Mr. Bradley was division engineer of the Illinois division at the time of his promotion to engineer maintenance of way of the First district on January 1.

Arthur C. Bradley

C. G. Grove, whose promotion to division engineer of the St. Louis division of the Pennsylvania, with headquarters at Terre Haute, Ind., was noted in the January issue, was born on December 20, 1890, at Muddy Creek Forks, Pa., and was educated at Pennsylvania State College. He entered railway service on September 9, 1912, as a rodman in the construction department of the Pennsylvania at Philadelphia, Pa., and was transferred to the maintenance of way department in 1913. In 1917 he was promoted to assistant supervisor on the Elmira division and later was transferred to the Allegheny division where he remained until September, 1917, when he was furloughed for military service, being assigned to the 104th Engineers

in the 29th Division. On his return from military duty in October, 1919, he was appointed assistant supervisor on the Monongahela division and later served in the same capacity on the Pittsburgh division. In 1920, he was promoted to supervisor on the Monongahela division and was transferred successively to the Buffalo and Eastern divisions. Mr. Grove was supervisor on the last-named division, with headquarters at Wooster, Ohio, at the time of his recent promotion to division engineer.

A. F. Kadow, of the chief engineer's office of the Chicago & Alton at Chicago, has been promoted to assistant engineer at Bloomington, Ill., to succeed **Walter T. Biggs**, who has resigned to become associated with the Coliani & Dire Company, railroad contractors, at Chicago.

L. W. Althof, division engineer of the Idaho division of the Oregon Short Line, with headquarters at Pocatello, Idaho, has been promoted to engineer maintenance of way with headquarters at the same point, to succeed **F. D. Nauman**, notice of whose death will be found elsewhere in this issue. **William C. Perkins**, roadmaster on the Montana division, with headquarters at Ashton, Idaho, has been promoted to division engineer of the Montana di-

L. W. Althof

vision at Pocatello to replace **M. H. Brown, Jr.**, who has been transferred to the Utah division at the same point to succeed **E. E. Moberly**, who has been transferred to the Idaho division to take the place of Mr. Althof.

Mr. Althof was born on July 31, 1886, at Oakland, Cal., and entered railway service in December, 1908, as a draftsman on the Southern Pacific. In May, 1911, he became an assistant engineer on the Oregon Short Line, and later served in various positions in the track and bridge and building departments. From October, 1916, to February, 1918, he was an assistant engineer in the maintenance of way department of the Union Pacific, engaged in special investigation work. In February, 1918, he left railway service to engage in ship construction, remaining in this work until April, 1923, when he returned to the Oregon Short Line as an assistant engineer. Mr. Althof was promoted to division engineer in 1925, which position he was holding at the time of his recent promotion to engineer maintenance of way.

George M. Davidson, industrial engineer of the Chicago & North Western, whose retirement on January 1 was noted in the January issue, was born at Newark, Ohio, on December 8, 1858, and graduated from Dartmouth College in 1880. During two summer vacations he worked as a chemist at Hanover, N. H., and for several months after leaving college he was engaged in coal mine surveys at Corning, Ohio, following which he became an assistant chemist for the Cambria

George M. Davidson

Steel Company at Johnstown, Pa. Mr. Davidson entered railway service in 1886 as chemist for the Chicago & North Western and established the first railway chemical laboratory in Chicago. In 1888, he was also appointed engineer of tests of the North Western and chemist and engineer of tests of the Chicago, St. Paul, Minneapolis & Omaha. In 1903, he perfected a system of treating water for locomotive use and later he developed a method of timber preservation. He was promoted to industrial engineer of the North Western in 1921, with supervision over laboratories, water supply, timber preservation and fuel consumption, which position he was holding at the time of his etirement.

Track

George J. Nash, assistant engineer on the Illinois Central at Chicago, has been appointed supervisor on the Chicago terminals, succeeding **C. D. Turley**, who has been appointed engineer in the office of the engineer maintenance of way at Chicago.

Max C. Michaelis has been appointed acting roadmaster on the Gulf, Colorado and Santa Fe, with headquarters at Sealy, Tex., succeeding **B. Rippenhagen**, whose transfer to Galveston, Tex., was noted in the December issue. **G. B. Hickok**, roadmaster at Slaton, Tex., has been transferred to the Plains division of the Atchison, Topeka & Santa Fe at Amarillo, Tex.

George H. Allen, roadmaster on the Canadian National, with headquarters at London, Ont., has retired after 39 years' service with that road. **S. K. Kimball**, roadmaster on the Regina division, with headquarters at Regina, Sask., has been transferred to the Saskatoon division, with headquarters at North Battleford, Sask., succeeding **C. Story**, who has been transferred to Regina to succeed Mr. Kimball.

Louis F. Racine, of the engineering department of the Oregon Short Line, has been promoted to roadmaster on the Montana division of the Oregon Short Line unit of the Union Pacific System, with headquarters at Ashton, Idaho, succeeding **W. C. Perkins**, whose promotion to division engineer is noted elsewhere in this issue. **George E. Hammock** has been appointed roadmaster on the same division with headquarters at Idaho Falls, Idaho, to succeed **A. T. Haas.**

George G. Smart, whose promotion to superintendent of work equipment on the Great Northern was noted in the December issue, was born on March 18, 1879, in England, and entered railway service in 1893 as a water boy on the Oregon-Washington Railroad & Navigation Company. He was promoted to section foreman in 1897 and in 1900 entered the service of the Great Northern where he was section foreman and extra gang foreman until 1906, when he was promoted to district roadmaster, with headquarters at Everett, Wash. In 1909, he was promoted to division roadmaster at Spokane, Wash., and later served in the same capacity at Havre, Mont., and Everett, Wash. In 1920, Mr. Smart was promoted to general roadmaster, with headquarters at St. Paul, Minn., which position he was holding at the time of his recent advancement to superintendent of work equipment, with headquarters at St. Paul.

H. Hill, assistant supervisor on the Pennsylvania at Parkton, Md., has been transferred to Middletown, Pa., to succeed **W. A. Trimble**, who has been promoted to supervisor, with headquarters at Osceola Mills, Pa., succeeding **J. R. Stam**, who has been transferred to Chambersburg, Pa., to replace **E. H. Armsby**, transferred to Williamsport, Pa., to succeed **D. M. Howard**, who, in turn has been transferred to Burgettstown, Ohio, to succeed **S. H. Kuhn**, whose promotion to assistant to the engineer maintenance of way of the Lake division is noted elsewhere in this issue. **Fred Lundberg**, acting general foreman on the Conemaugh division has been promoted to assistant supervisor on the Cleveland division at Wellsville, Ohio. **G. D. Market**, track foreman on the Renovo division, has been promoted to acting assistant supervisor on the Conemaugh division. **F. W. Artois**, assistant on engineer corps, has been promoted to assistant

supervisor on the Monongahela division to succeed **J. R. McGhee** who has been transferred to the Eastern division at Freedom, Pa., succeeding **Oliver Downs,** who has been promoted to supervisor on the Allegheny division at Dunkirk, N. Y., to succeed **A. R. DeWalt,** whose appointment as master carpenter on the Renovo division, with headquarters at Erie, Pa., is noted elsewhere. **I. E. Eckelberger,** general foreman on the Long Island, has been promoted to assistant supervisor on the Monongahela division of the Pennsylvania at West Brownsville, Pa., to succeed **J. J. Cassidy,** who has been assigned to other duties. **Festus Feeney,** supervisor on the Panhandle division at Carnegie, Pa., has been appointed assistant supervisor on the same division. **N. J. Allinger,** assistant supervisor on the Chicago Terminal division, has been transferred to the Ft. Wayne division at Van Wert, Ohio.

Bridge and Building

Garth H. Holmes, bridge and building foreman on the Missouri Pacific at North Little Rock, Ark., has been promoted to assistant supervisor of bridges and buildings on the Omaha division, with headquarters at Falls City, Neb.

B. M. Whitehouse, assistant general bridge inspector on the Chicago & North Western, with headquarters at Chicago, has been promoted to general bridge inspector, with headquarters at the same point to succeed **A. E. Bechtelheimer,** whose promotion to assistant engineer of bridges was noted in the January issue.

A. R. DeWalt, supervisor on the Allegheny division of the Pennsylvania, with headquarters at Dunkirk, N. Y., has been appointed master carpenter on the Renovo division, with headquarters at Erie, Pa., succeeding **P. X. Geary,** who has been transferred to the New York zone.

Obituary

Frank S. Bowen, retired supervisor on the Pennsylvania, died at Traverse City, Mich., on December 9, after a lingering illness, at the age of 77 years.

F. D. Nauman, engineer maintenance of way of the Oregon Short Line unit of the Union Pacific System, with headquarters at Pocatello, Idaho, died in that city on December 25, 1928.

Lawrence McNamara, roadmaster on the Norfolk & Western, with headquarters at Portsmouth, Ohio, died on December 2. Mr. McNamara was born on March 28, 1869, at Lexington, Va., and entered the service of the Norfolk & Western on May 12, 1890, as a helper in the shops at Roanoke, Va. He entered the track department on August 9, 1895, as a section laborer on the Scioto division and was promoted to section foreman on December 14, 1899. He was further promoted to roadmaster on June 10, 1909, which position he was holding at the time of his death.

Albert F. Robinson, bridge engineer of the Atchison, Topeka & Santa Fe System, with headquarters at Chicago, died at his home in Oak Park, Ill., on January 20. Mr. Robinson was born on October 12, 1854, at Henry, Ill., and graduated from the University of Illinois in June, 1880. He entered railway service in the following year as a chainman on the Denver & Rio Grande, returning to the University of Illinois in the winters of 1881 and 1882 to engage in a post-graduate course in bridges. He was bridge engineer of the Chicago & Alton in 1882 and 1883, following which he became assistant calculator and estimator for Kellogg & Maurice, engineers, at Athens, Pa. Mr. Robinson was appointed bridge engineer on the Santa Fe in July, 1884, and from September, 1885, to May, 1889, served in the same capacity on the Chicago, Burlington & Northern (now a part of the Chicago, Burlington & Quincy). Following this, he was connected with bridge and structural engineers in private practice until June, 1892, when he became an assistant engineer on the Chicago, Rock Island & Pacific, later engaging for two years in private practice. Mr. Robinson was appointed bridge engineer of the Santa Fe, with headquarters at Topeka, Kan., in November, 1896, being transferred to Chicago in 1904, where he was serving as bridge engineer of the system at the time of his death. Mr. Robinson was an active member of the American Railway Engineering Association.

Albert F. Robinson

Jesse G. June, division engineer on the Alleghany and Bradford divisions of the Erie, with headquarters at Salamanca, N. Y., died on December 31, 1928. Mr. June was born on March 15, 1866, at Manlius, N. Y., and entered railway service in June, 1884, in the engineering department of the Lehigh Valley. In 1901, he was promoted to supervisor of track at Easton, Pa., and in 1904 was made superintendent of the trolley lines of the Easton Transit Company. In December of the same year he was appointed division engineer on the Lehigh Valley at Auburn, N. Y., and in April, 1906, was transferred to Sayre, Pa., this being followed in 1907 by his transfer to Easton. In March, 1908, he entered the service of the Union Pacific at Green River, Wyo., and, in the following December, was appointed supervisor of track on the Erie, later being promoted to assistant division engineer. On January 1, 1910, Mr. June was promoted to division engineer, serving first on the Buffalo division, and later on the New York division with headquarters at Jersey City, N. J. On October 1, 1911, he was promoted to assistant superintendent of terminals at Jersey City, and on February 1, 1912, he was further promoted to superintendent of terminals at the same point. In 1915, he was appointed superintendent of the Alleghany and Bradford divisions, with headquarters at Salamanca, N. Y., later serving in the same capacity on the Buffalo division at Buffalo, N. Y., and on the Marion division at Huntington, Ind. Mr. June was appointed division engineer on the Alleghany and Bradford divisions with headquarters at Salamanca on April 1, 1928, and was holding this position at the time of his death.

Job Tuthill, assistant chief engineer of the Pere Marquette, notice of whose death on December 28, 1928, was published in the January issue, was born on October 26, 1855, at Blooming Grove, N. J., and graduated from the University of Michigan in 1883. After leaving college, he entered railway service as a member of the party which made the first survey for the Manitou & Pike's Peak, and in 1884, became a draftsman in the bridge department of the Chicago, Milwaukee & St. Paul. In September of the same year he became an assistant engineer on the Detroit, Lansing & Northern (now a part of the Pere Marquette) and in August, 1889, after that road became affiliated with the Chicago & West Michigan (now also a part of the Pere Marquette), he was promoted to assistant chief engineer of these roads, with headquarters at Grand Rapids, Mich., and in 1890, he was further promoted to engineer of bridges and buildings. During 1900, Mr. Tuthill was assistant engineer on the Grand Rapids district of the Pere Marquette and later was promoted to engineer of bridges, with headquaters at Detroit, Mich. From October, 1909, to July, 1911, he served as special engineer and as engineer maintenance of way of the Cincinnati, Hamilton & Dayton (now a part of the Baltimore & Ohio), resigning on the latter date to become engineer of buildings of the Kansas City Terminal during the construction of the Union Station at Kansas City, Mo. Following the completion of this work he was engaged in valuation work of public utilities and then for a short time was connected with the valuation department of the New York Central. He returned to the Pere Marquette in 1917 as chief engineer and in 1921 was appointed assistant chief engineer, which position he was holding at the time of his death.

The String Lining of Curves Made Easy

TO meet the many demands for the six articles, entitled "The String Lining of Curves Made Easy," by Charles H. Bartlett, which appeared serially in Railway Engineering and Maintenance from January to July, 1928, we have reproduced these articles in pamphlet form.

Here is a manual of instruction giving a method of correcting alinement which is quicker and more convenient than the use of engineering instruments.

Increasing importance of accurate curve maintenance and the frequent necessity for checking curve alinement make this simple method of value to all engaged in the lining of curves.

This method was developed by the author while actually engaged in the operation of lining curves on one of the country's largest roads.

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Buda Co.

Drills, Pneumatic
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Drills, Rock
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Drills, Track
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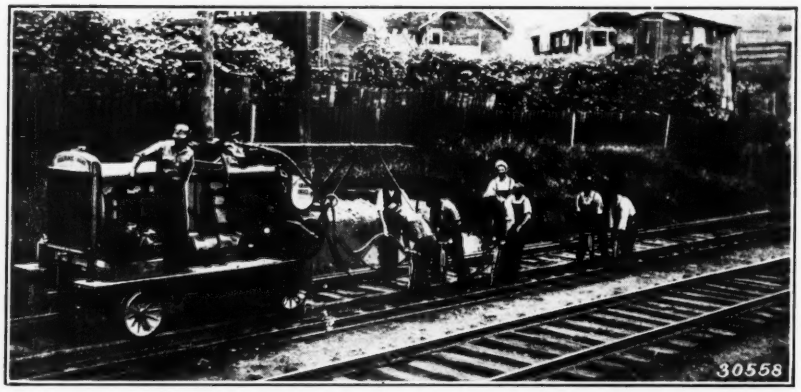

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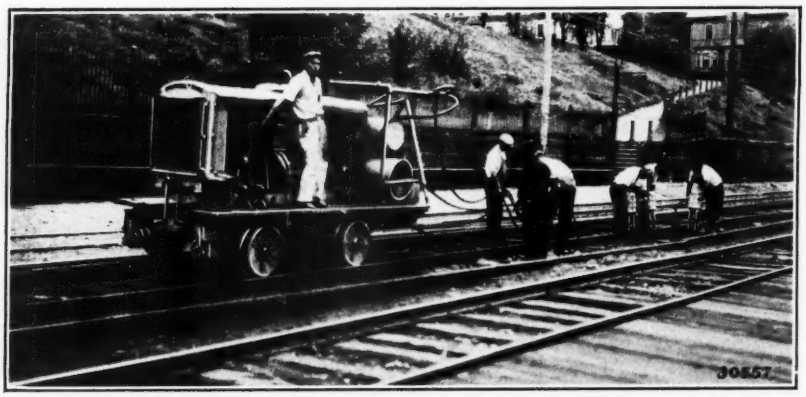

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